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Hashiguchi

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(54) **CONNECTOR FOR OVERLAPPING TWO CIRCUIT BOARDS**

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H01R 12/73	(2011.01)
H01R 12/63	(2011.01)
H01R 13/645	(2006.01)

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CPC ***H01R 12/7005*** (2013.01); ***H01R 12/613*** (2013.01); ***H01R 12/7052*** (2013.01); ***H01R 12/7064*** (2013.01); ***H01R 12/73*** (2013.01); *H01R 12/63* (2013.01); *H01R 13/6456* (2013.01)

(58) **Field of Classification Search**

CPC H01R 12/7005; H01R 12/73; H01R 12/59; H01R 12/592; H01R 12/61; H01R 12/62; H01R 12/613; H01R 12/718; H01R 12/81; H01R 13/64; H01R 13/642

USPC 439/74, 67, 77, 493, 55, 65, 66, 73, 75, 439/374

See application file for complete search history.

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(57) **ABSTRACT**

A connector includes a flat plate portion and one or more guide pins protruding formed on a surface of the flat plate portion, each of the one or more guide pins having a first fitting portion disposed on a root side of the guide pin and fitted with a first circuit board and a second fitting portion disposed on a tip side of the guide pin and fitted with a second circuit board, the first fitting portion being larger in size than the second fitting portion in a direction perpendicular to a connecting direction.

20 Claims, 8 Drawing Sheets

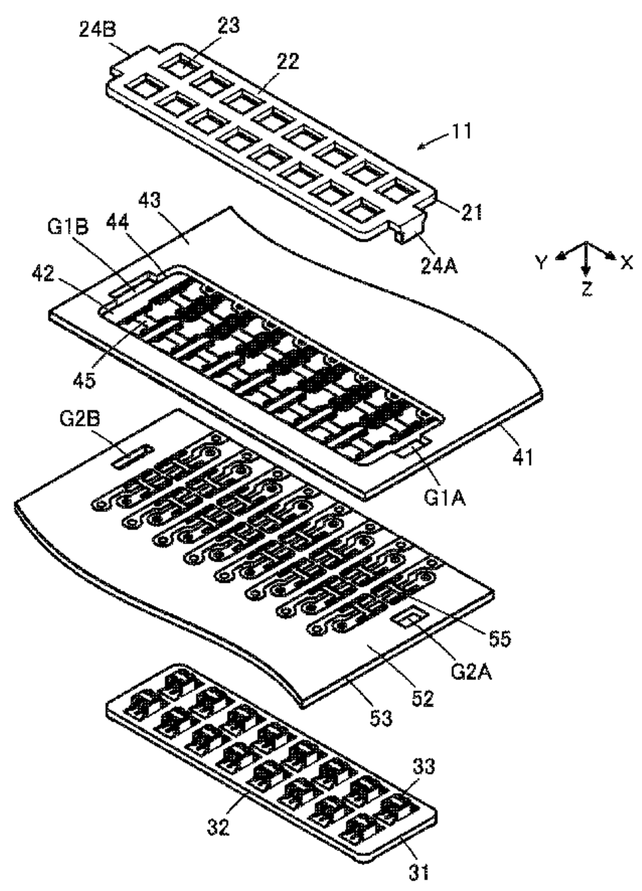

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FIG. 1

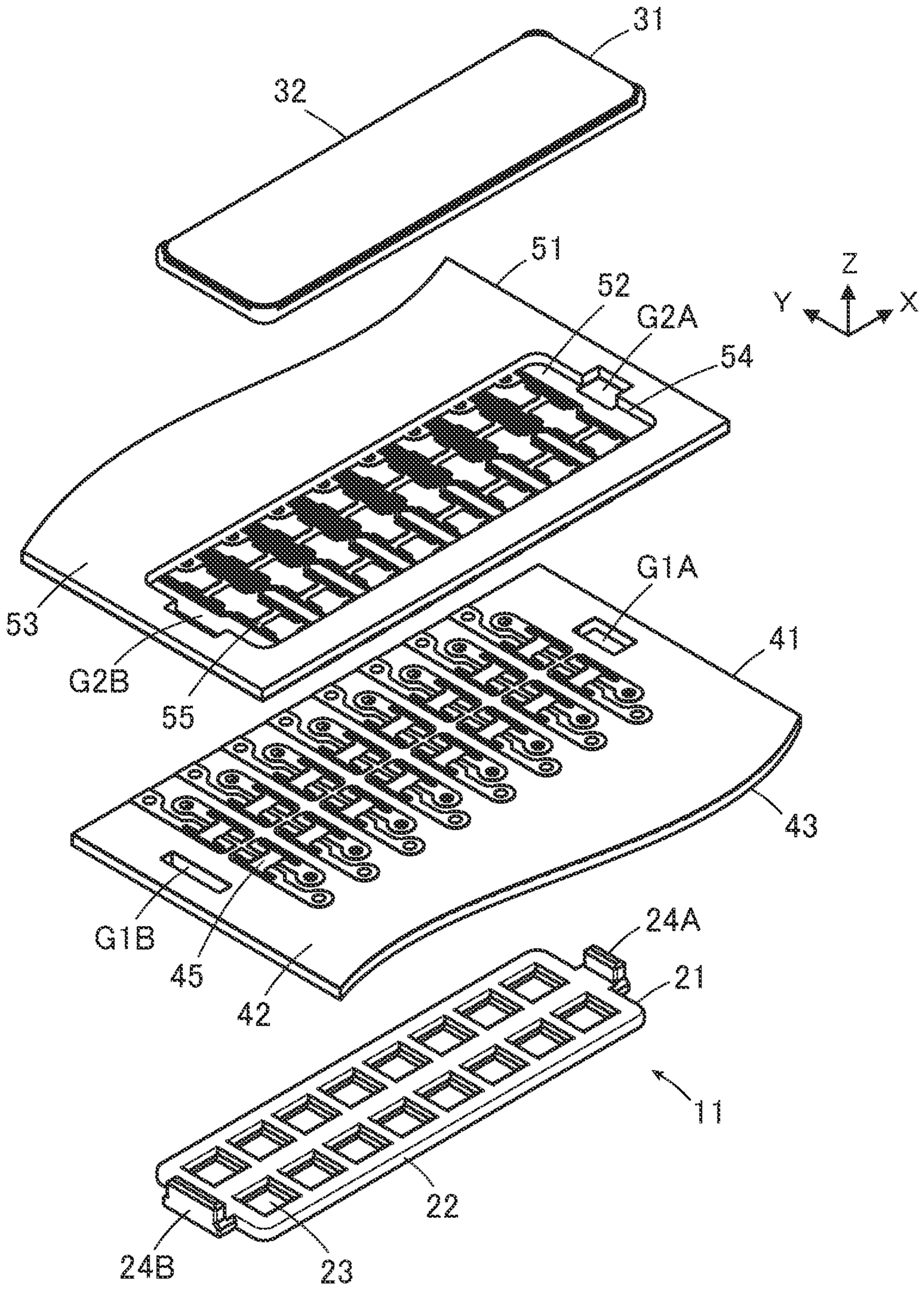

31
32
51
52
G2A
54
Z
Y
X
53
G1A
41
G2B
55
43
G1B
24A
45
21
42
11
22
24B
23

FIG. 2

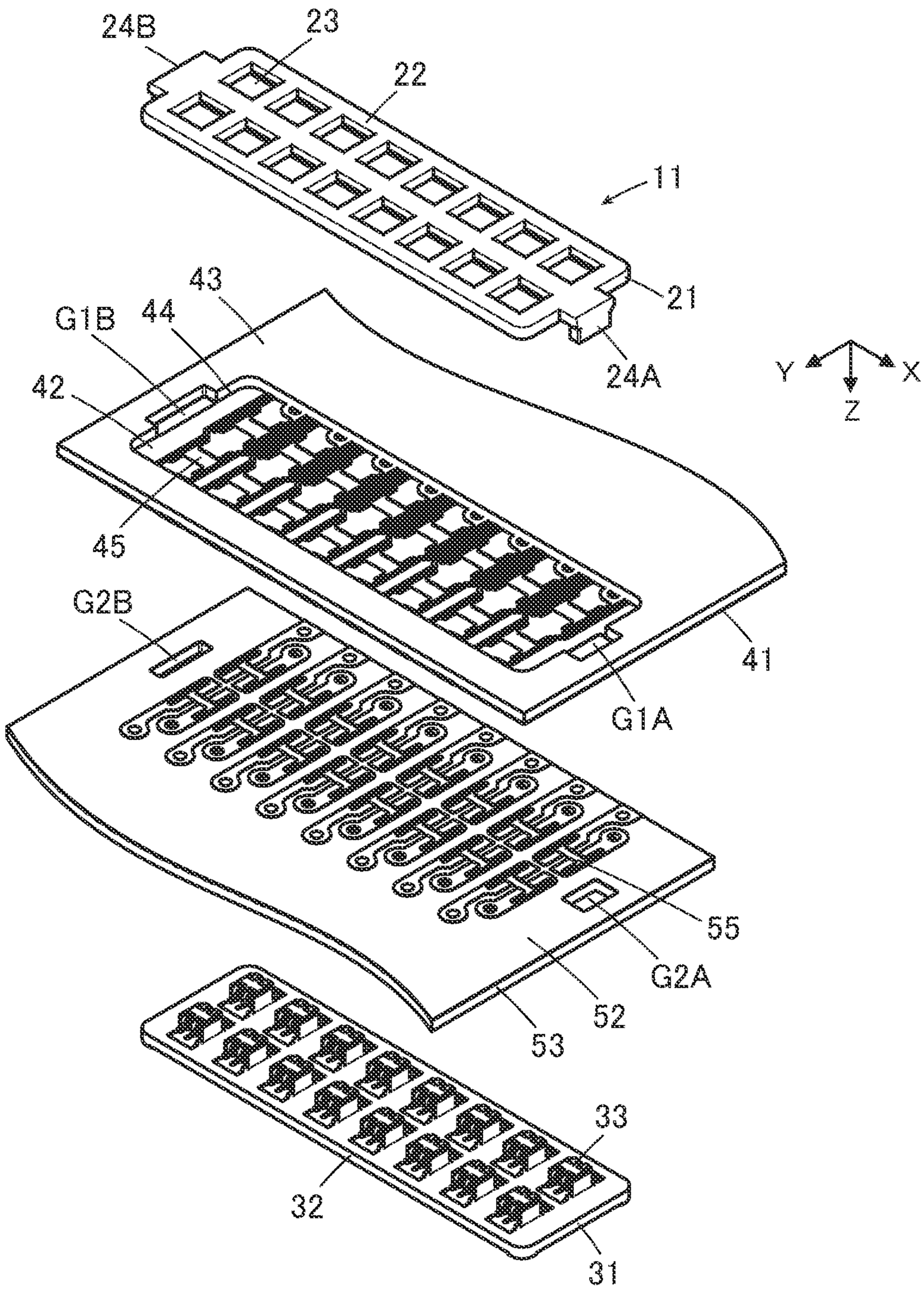

24B
23
22
11
21
43
G1B
44
24A
Y
X
Z
42
45
G2B
41
G1A
55
G2A
52
53
33
32
31

FIG. 3

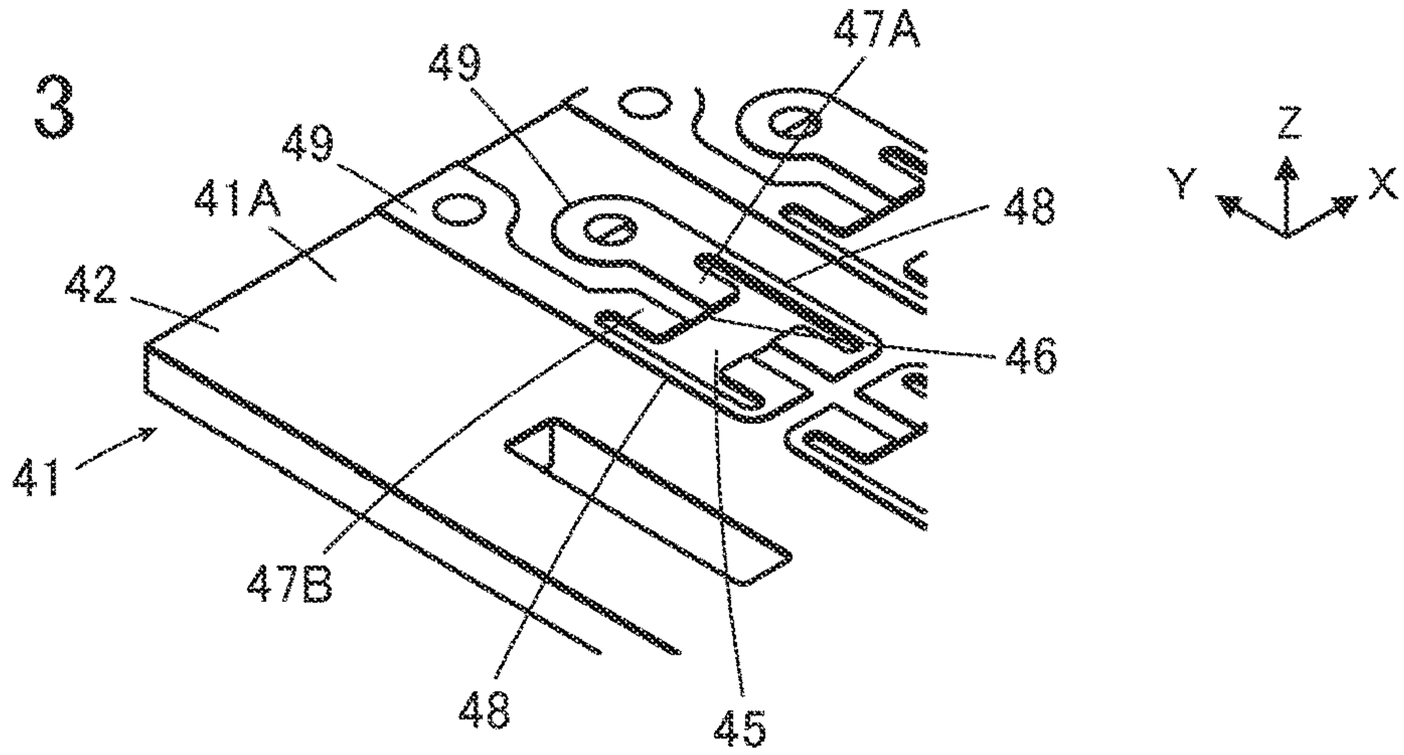


FIG. 4

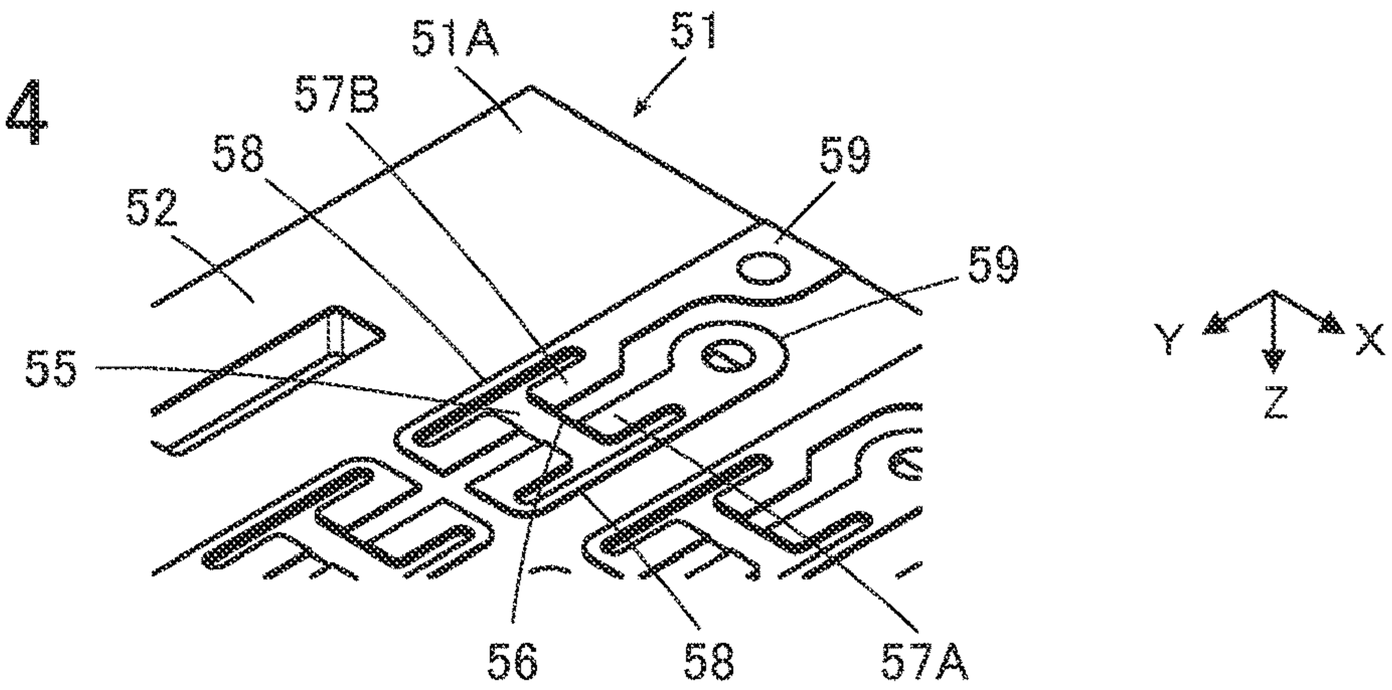


FIG. 5

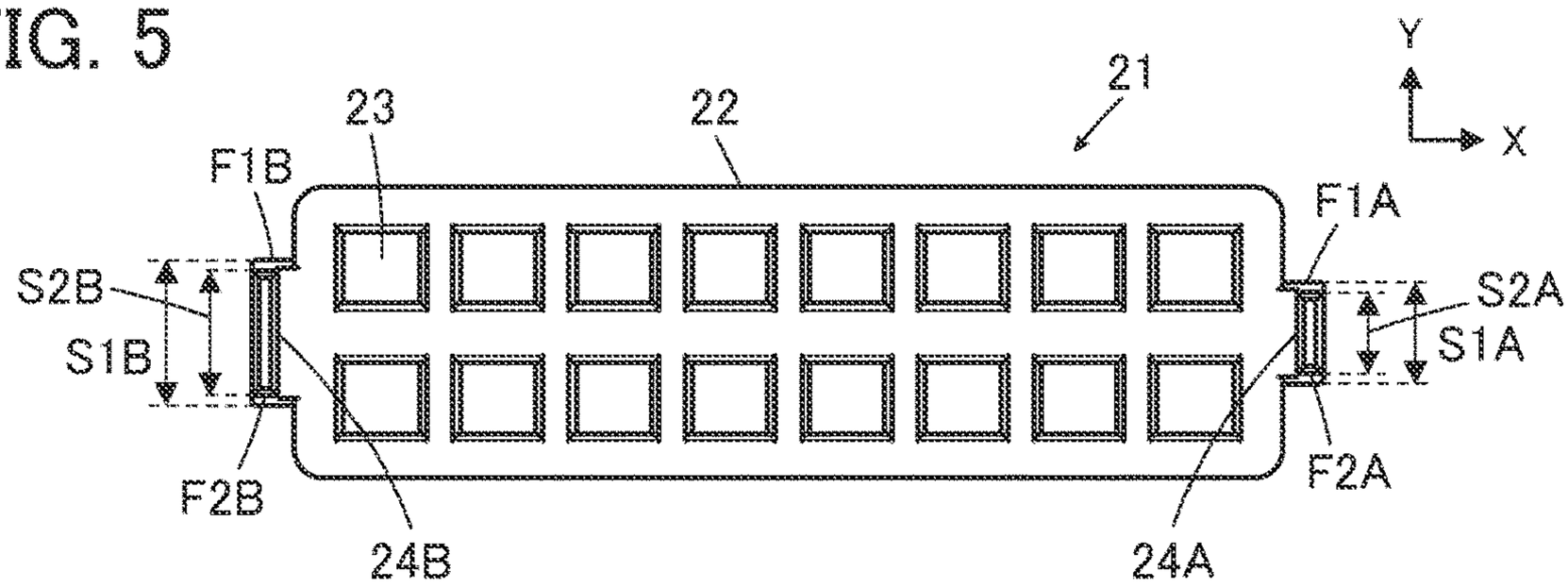


FIG. 6

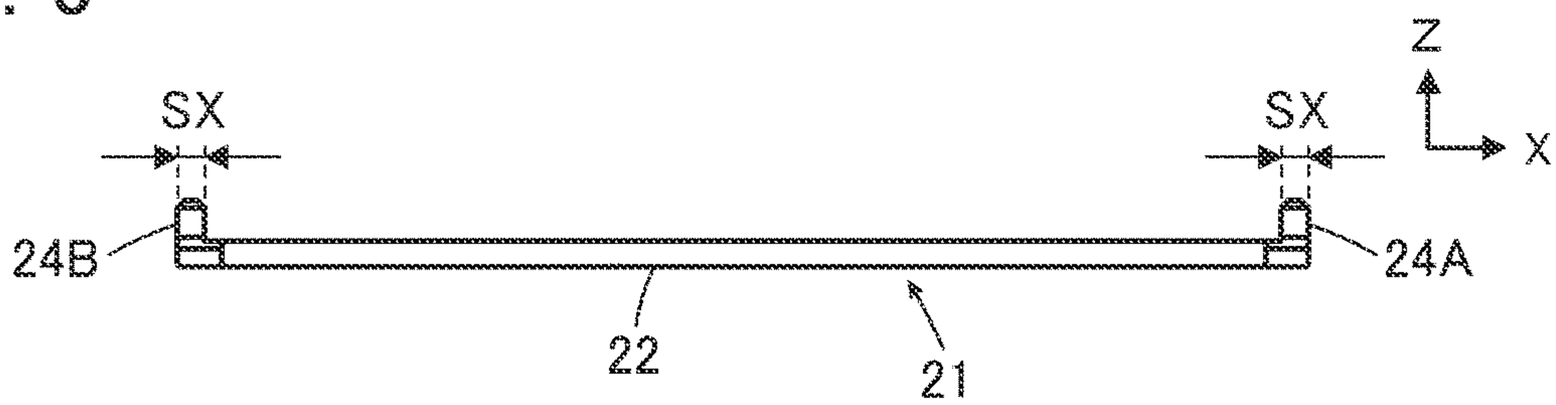


FIG. 7

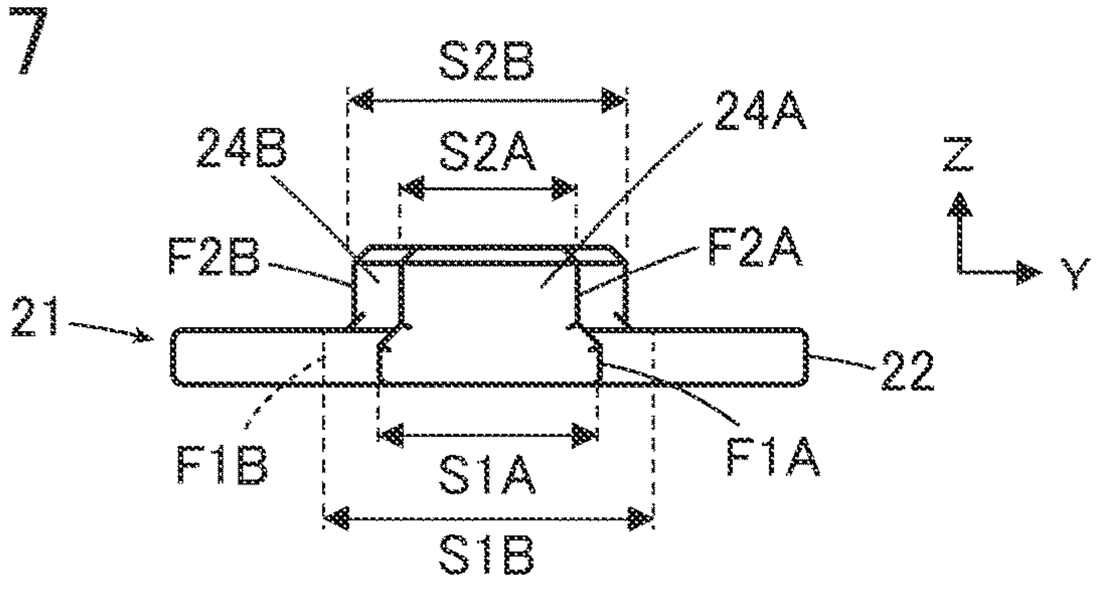


FIG. 8

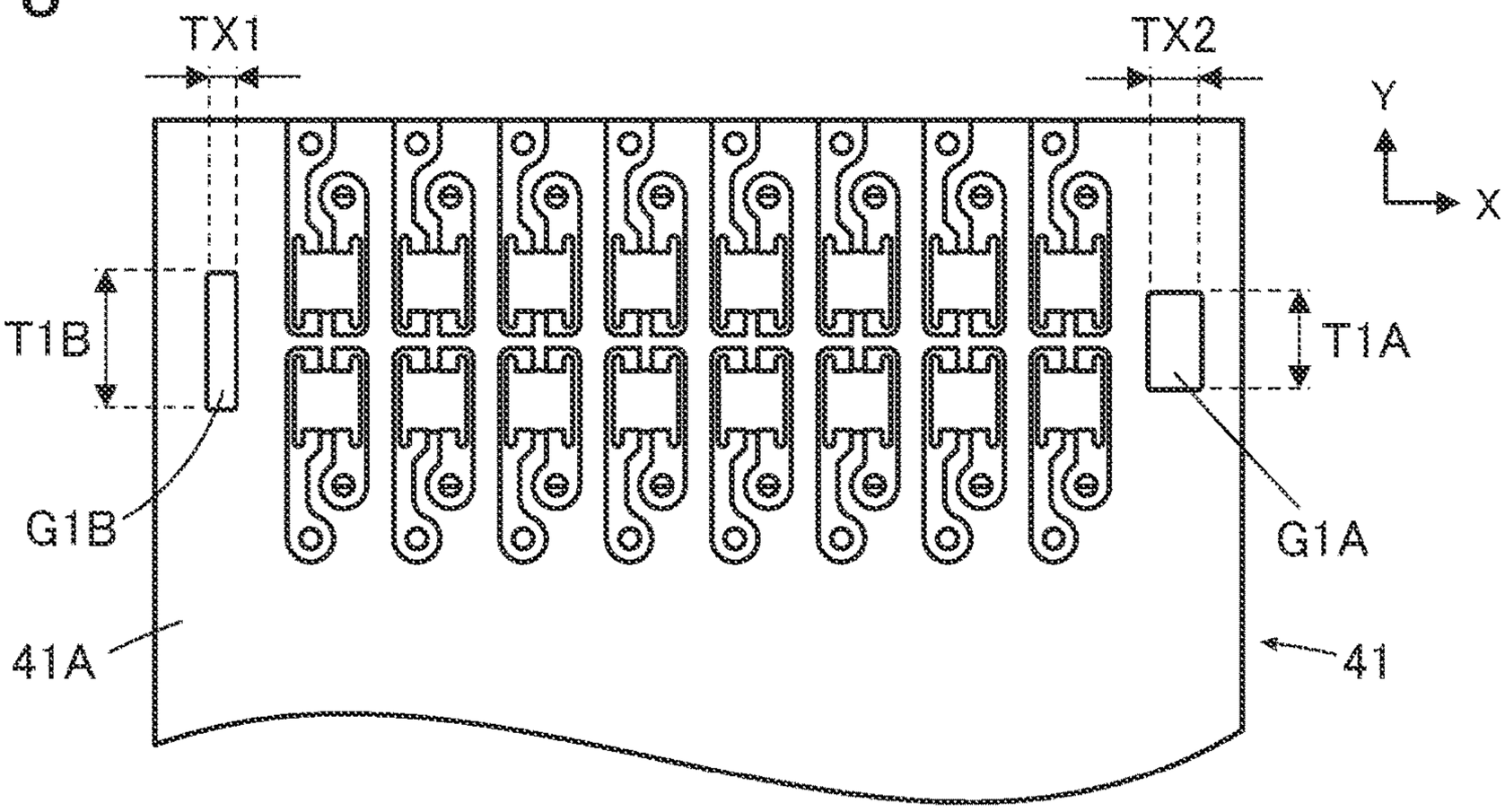


FIG. 9

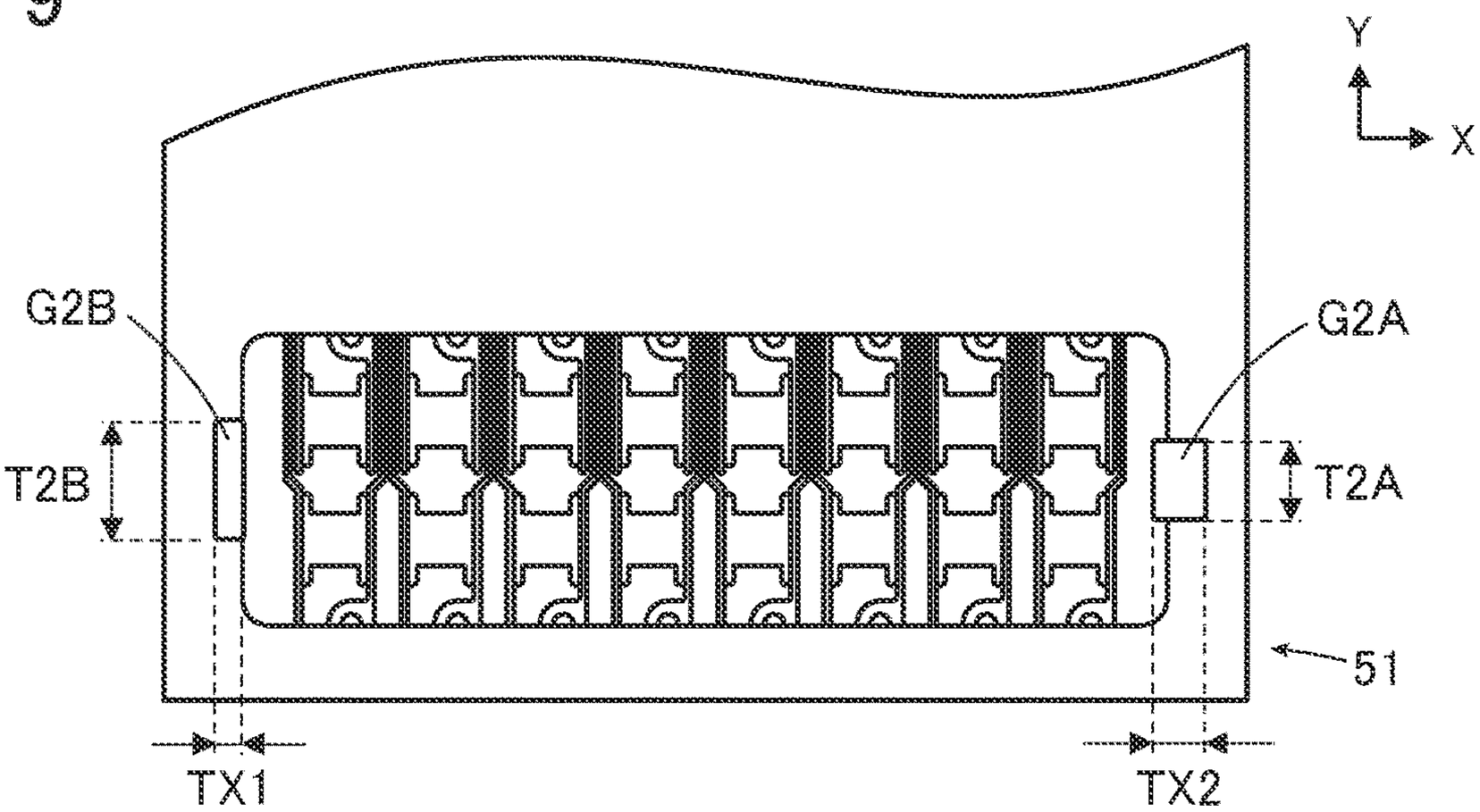


FIG. 10

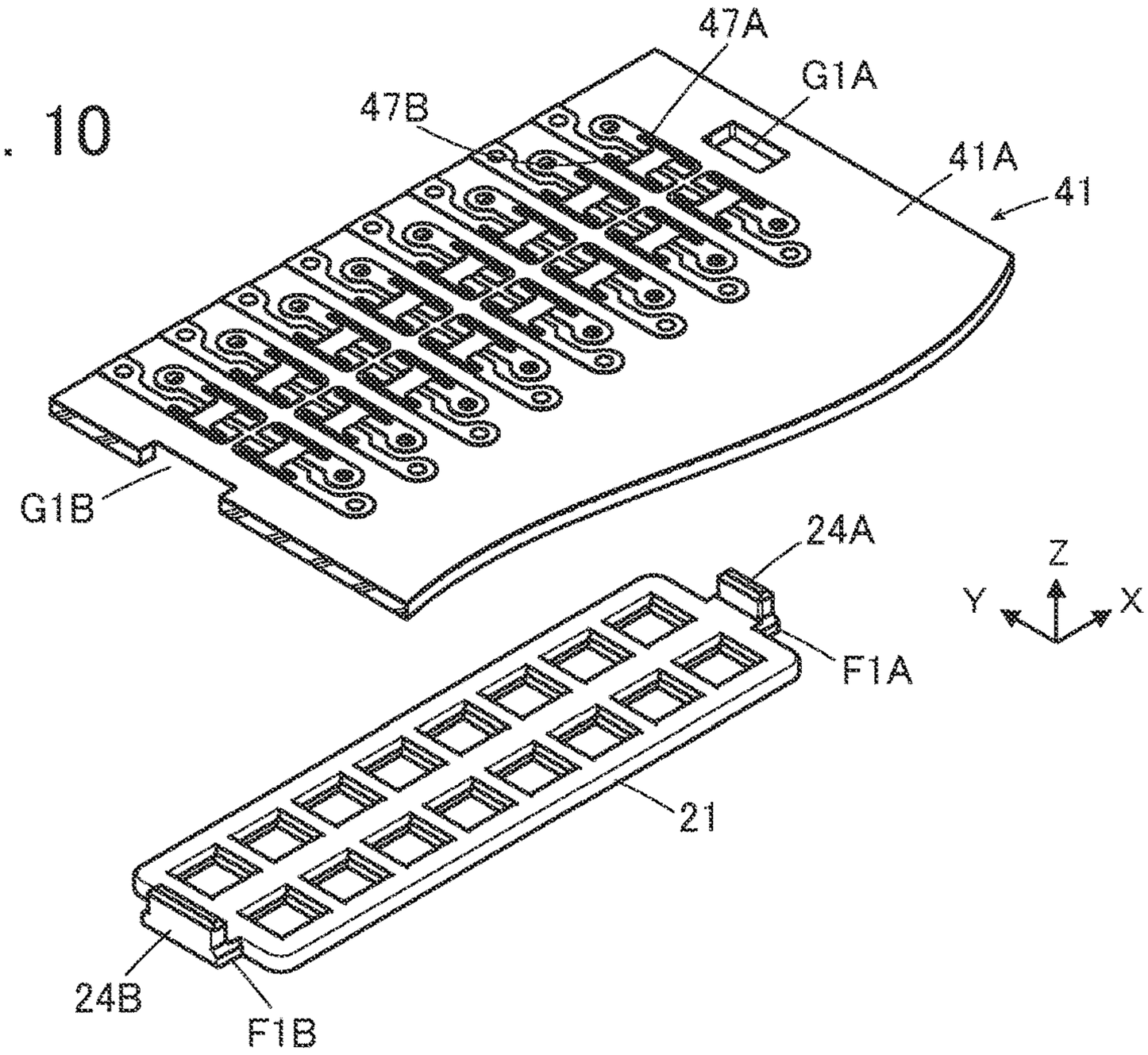

47A
G1A
47B
41A
41
G1B
24A
Z
Y
X
F1A
21
24B
F1B

FIG. 11

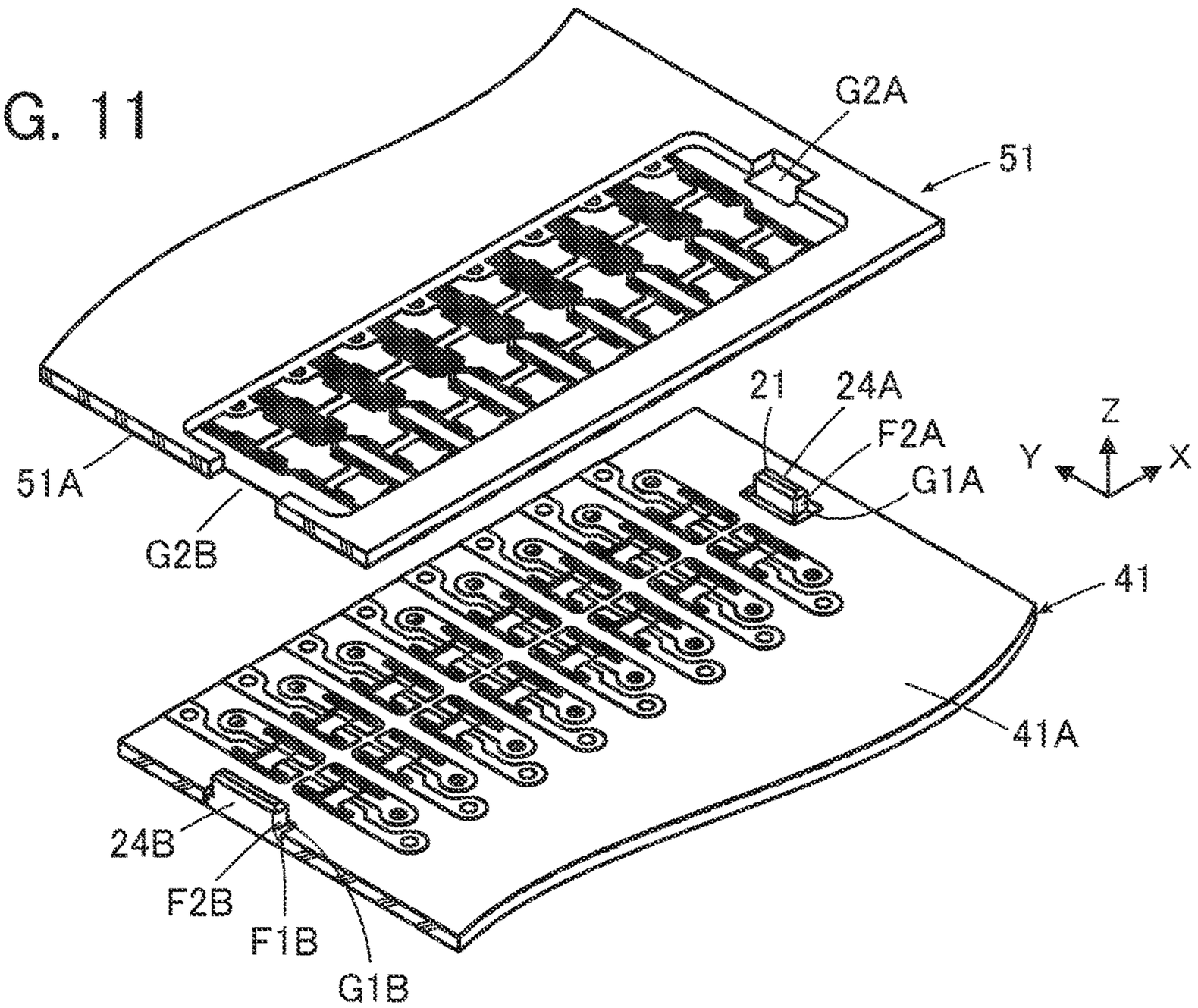

G2A
51
51A
G2B
21
24A
F2A
G1A
Z
Y
X
41
41A
24B
F2B
F1B
G1B

FIG. 12

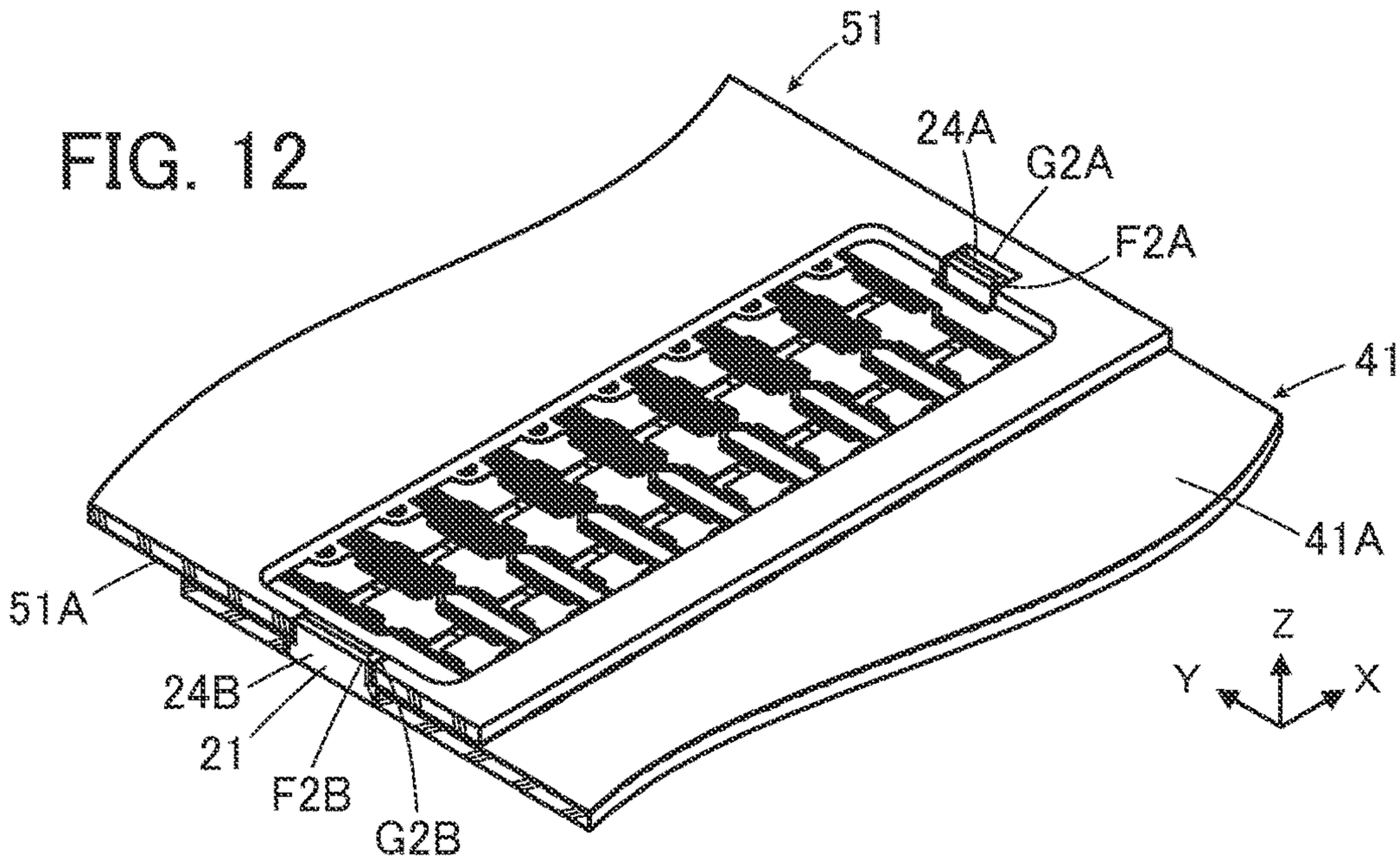

51
24A
G2A
F2A
41
41A
51A
Z
Y
X
24B
21
F2B
G2B

FIG. 13

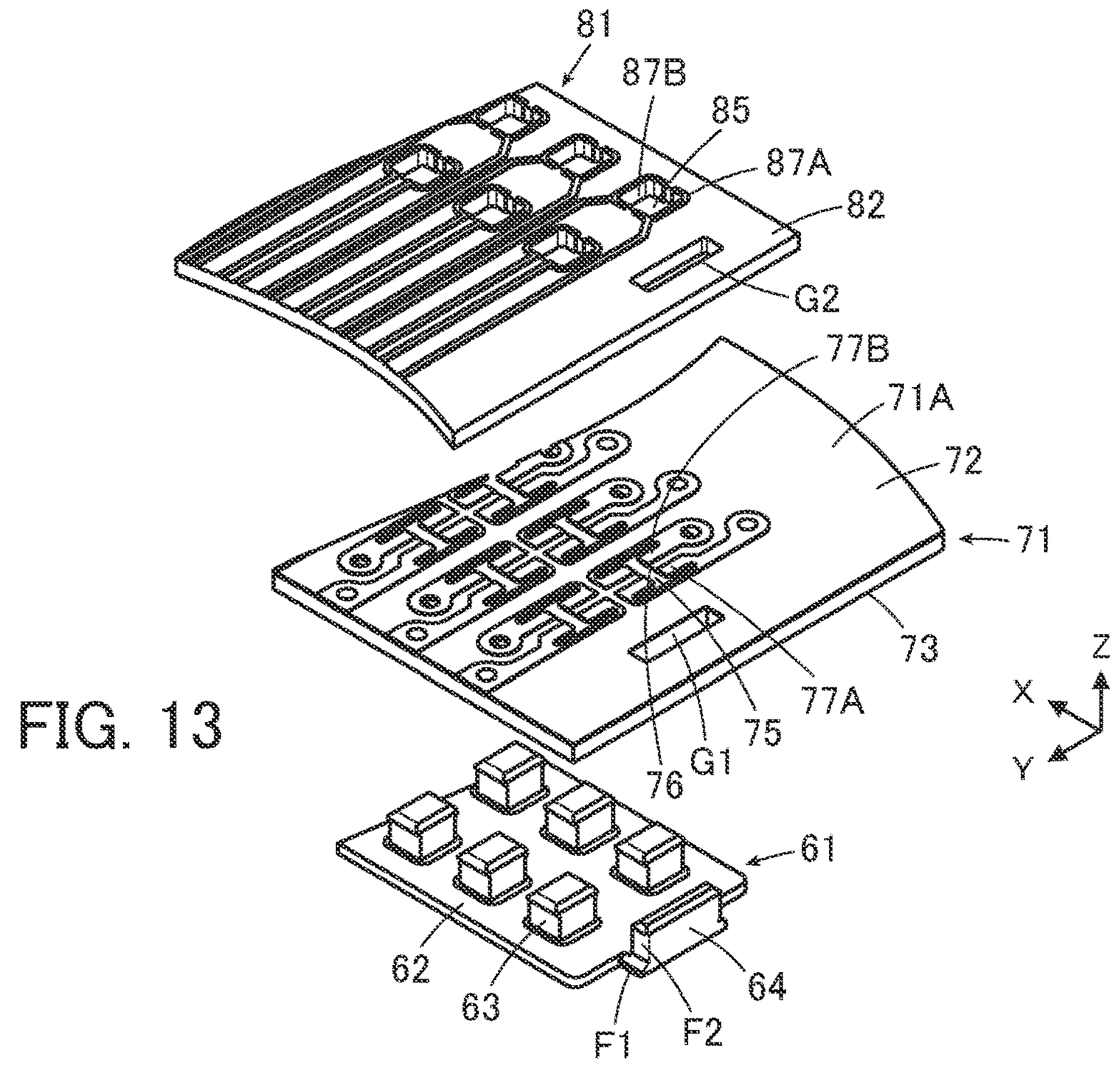

81
87B
85
87A
82
G2
77B
71A
72
71
73
77A
75
G1
76
Z
X
Y
61
62
63
F1
F2
64

FIG. 14

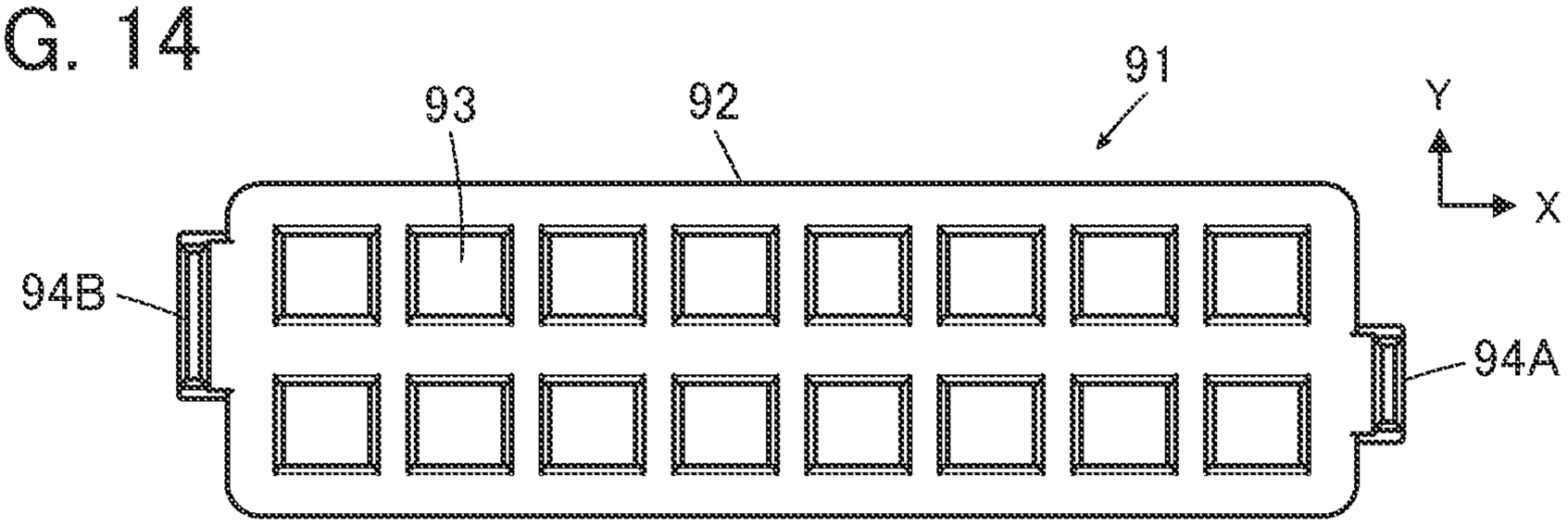


FIG. 15

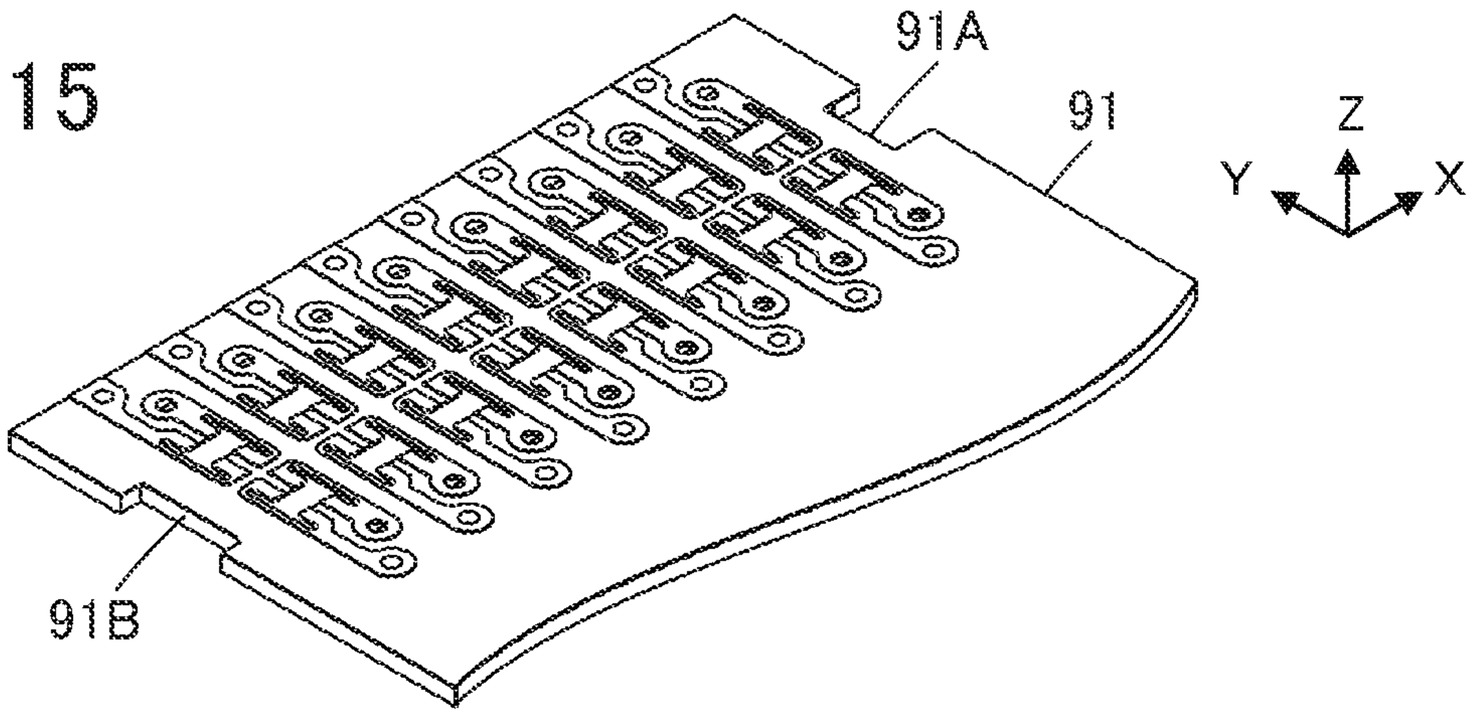


FIG. 16
PRIOR ART

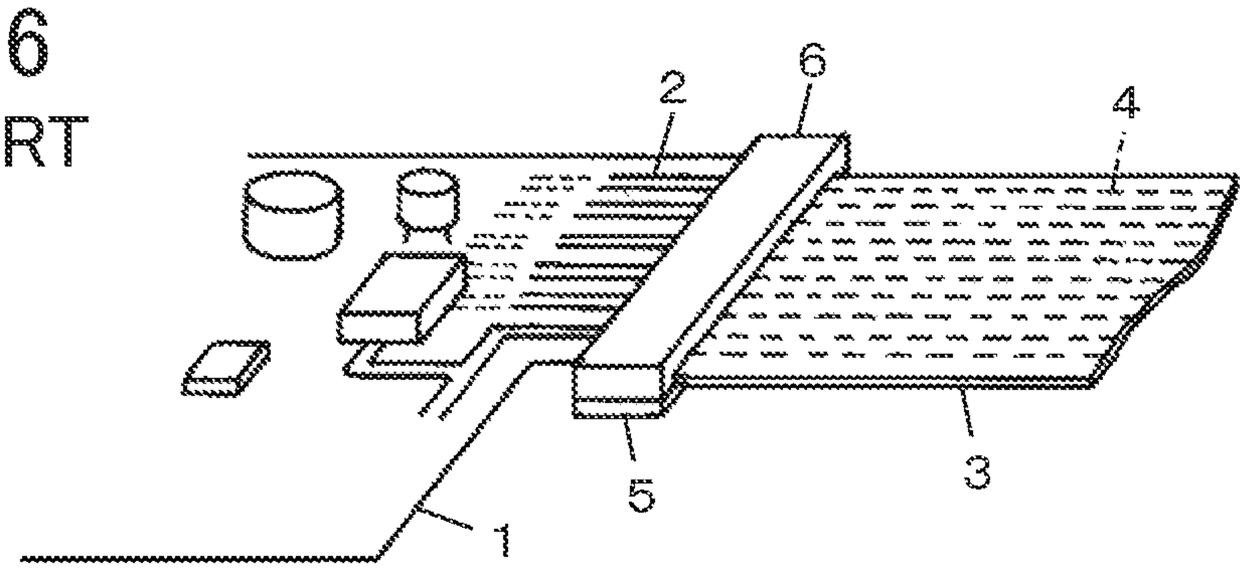
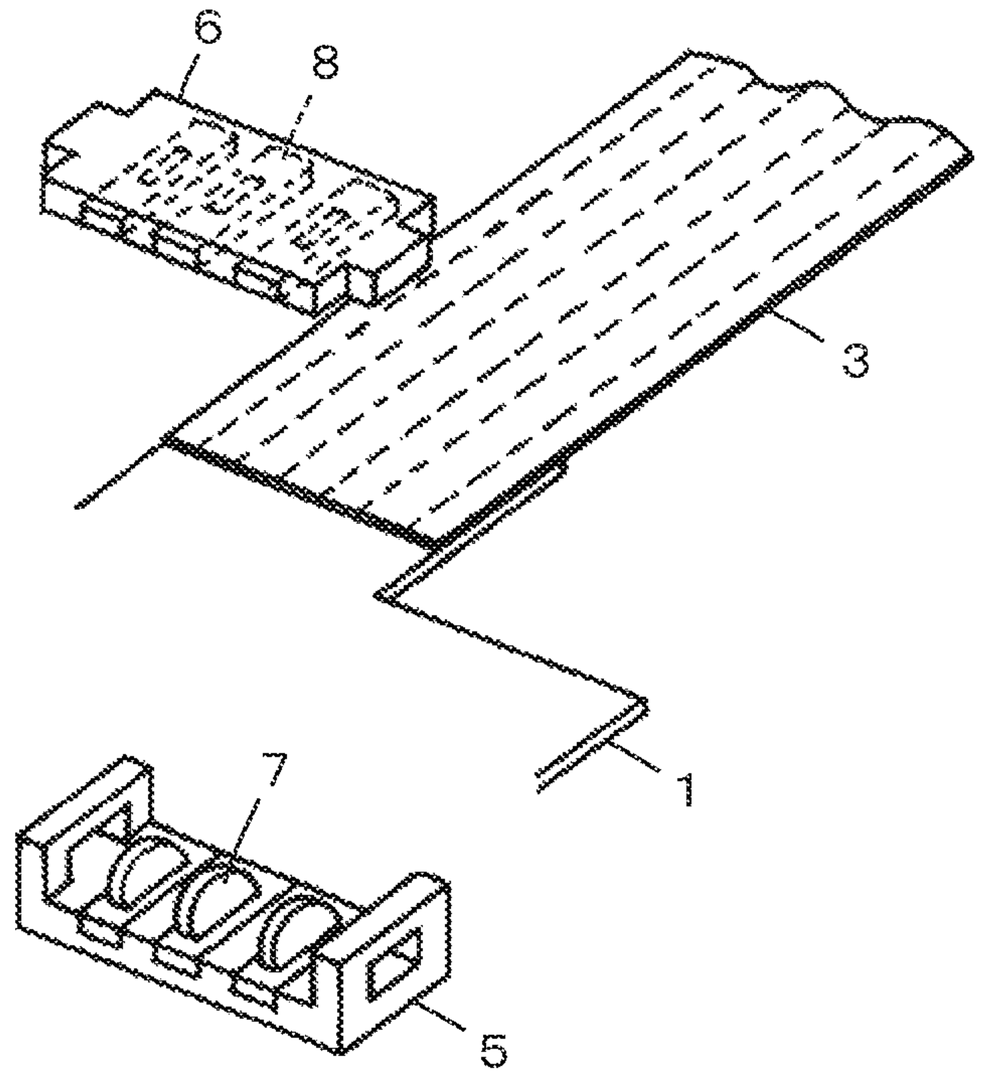


FIG. 17
PRIOR ART



CONNECTOR FOR OVERLAPPING TWO CIRCUIT BOARDS

BACKGROUND OF THE INVENTION

The present invention relates to a connector, particularly to a connector that enables a first circuit board having a first contact portion and a second circuit board having a second contact portion to be overlapped on each other to electrically connect the first contact portion and the second contact portion to each other.

As an exemplary connector used to connect two flat circuit boards that are overlapped on each other, JP 2005-122901 A discloses a connector for connecting a plurality of circuit conductors **2** arranged in a flexible printed circuit board (FPC) **1** with a plurality of flat conductors **4** in a flat cable **3** as shown in FIG. **16**. This connector is composed of a connector body **5** and a plate member **6** that face each other so as to sandwich an overlap part where the FPC **1** and the flat cable **3** overlap. As shown in FIG. **17**, the connector body **5** has a plurality of metallic penetrating pieces **7**, while the plate member **6** has a plurality of receiving grooves **8** formed therein.

The flat cable **3** is placed on the surface of the FPC **1**, and the connector body **5** and the plate member **6** are positioned with respect to the FPC **1** and the flat cable **3** such that the penetrating pieces **7** and the receiving grooves **8** separately correspond to the circuit conductors **2** of the FPC **1** and the flat conductors **4** of the flat cable **3**. In this state, the penetrating pieces **7** of the connector body **5** are thrust into the overlap part where the FPC **1** and the flat cable **3** overlap, and accordingly, the circuit conductors **2** of the FPC **1** and the flat conductors **4** in the flat cable **3** are sheared by the penetrating pieces **7**. Upon insertion of the penetrating pieces **7**, sheared parts of the circuit conductors **2** and sheared parts of the flat conductors **4** come into contact with the metallic penetrating pieces **7**. As a result, the circuit conductors **2** of the FPC **1** and the flat conductors **4** of the flat cable **3** are electrically connected via the penetrating pieces **7**.

If, however, the FPC **1** and the flat cable **3** are overlapped in a wrong order, i.e., if the FPC **1** is placed on the surface of the flat cable **3**, even when the penetrating pieces **7** of the connector body **5** are thrust into the overlap part where the FPC **1** and the flat cable **3** overlap, the circuit conductors **2** of the FPC **1** and the flat conductors **4** in the flat cable **3** may fail to establish their electrical connections.

In particular, when two circuit boards having similar shapes are overlapped and connected to each other, it becomes easy to mistake the order of overlapping the circuit boards.

SUMMARY OF THE INVENTION

The present invention has been made to overcome the conventional problem as above and aims at providing a connector that enables two circuit boards to be reliably overlapped in a proper order and electrically connected to each other.

A connector according to the present invention is one for overlapping a first circuit board having a first contact portion and a second circuit board having a second contact portion in a connecting direction to electrically connect the first contact portion and the second contact portion to each other, the connector comprising:

a flat plate portion; and

one or more guide pins protrudingly formed on a surface of the flat plate portion,

wherein each of the one or more guide pins includes a first fitting portion disposed on a root side of the guide pin and fitted with the first circuit board and a second fitting portion disposed on a tip side of the guide pin and fitted with the second circuit board, and the first fitting portion is larger in size than the second fitting portion in a direction perpendicular to the connecting direction

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a first circuit board and a second circuit board disposed between a first connector portion and a second connector portion of a connector according to Embodiment 1 of the present invention, as seen from obliquely above.

FIG. **2** is a perspective view of the first circuit board and the second circuit board disposed between the first connector portion and the second connector portion of the connector according to Embodiment 1, as seen from obliquely below.

FIG. **3** is an enlarged partial perspective view of the first circuit board.

FIG. **4** is an enlarged partial perspective view of the second circuit board.

FIG. **5** is a plan view showing the first connector portion.

FIG. **6** is a front view showing the first connector portion.

FIG. **7** is a side view showing the first connector portion.

FIG. **8** is a view showing a top surface of the first circuit board.

FIG. **9** is a view showing a bottom surface of the second circuit board.

FIG. **10** is a partially broken perspective view showing the state where the first circuit board is positioned with respect to the first connector portion.

FIG. **11** is a partially broken perspective view showing the state where the second circuit board is positioned with respect to the first connector portion fitted with the first circuit board.

FIG. **12** is a partially broken perspective view showing the state where the first connector portion is fitted with the first circuit board and the second circuit board.

FIG. **13** is a perspective view showing the state where a first circuit board and a second circuit board are positioned with respect to a connector according to Embodiment 2.

FIG. **14** is a plan view showing a first connector portion used in a connector according to Embodiment 3.

FIG. **15** is a partial perspective view showing a first circuit board used in a connector according to a modification.

FIG. **16** is a perspective view showing a conventional connector connecting an FPC and a flat cable.

FIG. **17** is an exploded perspective view of the conventional connector connecting the FPC and the flat cable.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments of the present invention are described below based on the appended drawings.

Embodiment 1

FIGS. **1** and **2** show a connector **11** according to Embodiment 1 and a first circuit board **41** and a second circuit board **51** that are to be connected to each other by means of the connector **11**, before assembling.

The connector **11** is composed of a first connector portion **21** and a second connector portion **31** that are detachable from each other. The first connector portion **21**, the second connector portion **31**, the first circuit board **41** and the second circuit board **51** are each a flat plate member and are arranged parallel to each other. The first circuit board **41** and the second circuit board **51** are sequentially arranged between the first connector portion **21** and the second connector portion **31**.

The first connector portion **21** of the connector **11** includes a fitting plate (flat plate portion) **22** having insulation properties and a plurality of fitting holes **23** penetrating the fitting plate **22**. The fitting holes **23** are arranged in two rows each having eight fitting holes **23** arranged at equal intervals. Thus, 16 fitting holes **23** are formed in total.

The first connector portion **21** further includes two guide pins **24**A and **24**B formed separately at the opposite ends of the fitting plate **22** to project in a direction perpendicular to the fitting plate **22**.

As shown in FIG. **2**, the second connector portion **31** of the connector **11** includes a base plate **32** having insulation properties and a plurality of projections **33** projecting on the surface of the base plate **32**. Each projection **33** is formed from a metal spring and has elasticity. The projections **33** are arranged in two rows each having eight projections **33** arranged at equal intervals, and thus, 16 projections **33** are formed in total correspondingly to the 16 fitting holes **23** of the first connector portion **21**.

For convenience, the first connector portion **21**, the second connector portion **31**, the first circuit board **41** and the second circuit board **51** are defined as extending along an XY plane, the direction in which eight fitting holes **23** are arranged in each row of the first connector portion **21** and eight projections **33** are arranged in each row of the second connector portion **31** is referred to as "X direction," the direction perpendicular to the X direction in an XY plane is referred to as "Y direction," and the direction from the first connector portion **21** to the second connector portion **31** is referred to as "+Z direction."

In the first connector portion **21**, the guide pin **24**A projects in the +Z direction from the +X directional end of the fitting plate **22**, while the guide pin **24**B projects in the +Z direction from the −X directional end of the fitting plate **22**.

The projections **33** of the second connector portion **31** project in the −Z direction from the −Z direction-side surface of the base plate **32**.

The first circuit board **41** includes a flexible first substrate **42** having insulation properties and a first reinforcement plate **43** joined to the −Z direction-side surface of the first substrate **42**. The first reinforcement plate **43** has an opening **44** formed in the vicinity of its +Y directional end which penetrates the first reinforcement plate **43** and into which the fitting plate **22** of the first connector portion **21** is inserted. The first substrate **42** has a plurality of first through holes **45** of H shape arranged to be positioned within the opening **44** of the first reinforcement plate **43**. The first through holes **45** are arranged in two rows each having eight first through holes **45** arranged in the X direction at equal intervals. Thus, 16 first through holes **45** are formed in total.

Further, the first circuit board **41** has first opening portions G**1**A and G**1**B formed separately at the +X and −X directional ends of the opening **44** of the first reinforcement plate **43**, each of the first opening portions G**1**A and G**1**B being a hole penetrating both the first substrate **42** and the first reinforcement plate **43**.

As shown in FIG. **3**, a pair of first protruding pieces **46** constituted of part of the flexible first substrate **42** are formed in each first through hole **45** of the first circuit board **41**. A pair of first contact portions **47**A and a pair of first contact portions **47**B are formed on the pair of first protruding pieces **46** on a surface **41**A, facing in the +Z direction, of the first circuit board **41**. The pair of first contact portions **47**A are electrically interconnected by a conductive portion **48** formed at the +X direction-side edge of the first through hole **45**, while the pair of first contact portions **47**B are electrically interconnected by a conductive portion **48** formed at the −X direction-side edge of the first through hole **45**. The conductive portion **48** connecting the pair of first contact portions **47**A and the conductive portion **48** connecting the pair of first contact portions **47**B are each connected to a pad portion **49**.

As shown in FIGS. **1** and **2**, the second circuit board **51** includes a flexible second substrate **52** having insulation properties and a second reinforcement plate **53** joined to the +Z direction-side surface of the second substrate **52**. The second reinforcement plate **53** has an opening **54** formed in the vicinity of its −Y directional end which penetrates the second reinforcement plate **53** and into which the base plate **32** of the second connector portion **31** is inserted. The second substrate **52** has a plurality of second through holes **55** of H shape arranged to be positioned within the opening **54** of the second reinforcement plate **53**. The second through holes **55** are arranged in two rows each having eight second through holes **55** arranged in the X direction at equal intervals. Thus, 16 second through holes **55** are formed in total.

Further, the second circuit board **51** has second opening portions G**2**A and G**2**B formed separately at the +X and −X directional ends of the opening **54** of the second reinforcement plate **53**, each of the second opening portions G**2**A and G**2**B being a hole penetrating both the second substrate **52** and the second reinforcement plate **53**.

As shown in FIG. **4**, a pair of second protruding pieces **56** constituted of part of the flexible second substrate **52** are formed in each second through hole **55** of the second circuit board **51**. A pair of second contact portions **57**A and a pair of second contact portions **57**B are formed on the pair of second protruding pieces **56** on a surface **51**A, facing in the −Z direction, of the second circuit board **51**. The pair of second contact portions **57**A are electrically interconnected by a conductive portion **58** formed at the +X direction-side edge of the second through hole **55**, while the pair of second contact portions **57**B are electrically interconnected by a conductive portion **58** formed at the −X direction-side edge of the second through hole **55**. The conductive portion **58** connecting the pair of second contact portions **57**A and the conductive portion **58** connecting the pair of second contact portions **57**B are each connected to a pad portion **59**.

As shown in FIGS. **5** to **7**, the guide pin **24**A projecting in the +Z direction from the +X directional end of the fitting plate **22** of the first connector portion **21** has such a shape that the width of the guide pin **24**A in the Y direction varies in two stages as advancing in the +Z direction. The guide pin **24**A includes a first fitting portion F**1**A disposed on the root side, i.e., the −Z direction side of the guide pin **24**A and a second fitting portion F**2**A disposed on the tip side, i.e., the +Z direction side thereof. A width S**1**A of the first fitting portion F**1**A is larger than a width S**2**A of the second fitting portion F**2**A in the Y direction perpendicular to the Z direction.

When the first circuit board **41** and the second circuit board **51** are connected using the connector **11**, the guide pin

24A of the first connector portion 21 is inserted into the first opening portion G1A of the first circuit board 41 and the second opening portion G2A of the second circuit board 51, and at this time, the first fitting portion F1A of the guide pin 24A is fitted in the first opening portion G1A of the first circuit board 41, while the second fitting portion F2A of the guide pin 24A is fitted in the second opening portion G2A of the second circuit board 51.

Likewise, the guide pin 24B projecting in the +Z direction from the −X directional end of the fitting plate 22 has such a shape that the width of the guide pin 24B in the Y direction varies in two stages as advancing in the +Z direction. The guide pin 24B includes a first fitting portion F1B disposed on the root side, i.e., the −Z direction side of the guide pin 24B and a second fitting portion F2B disposed on the tip side, i.e., the +Z direction side thereof. A width S1B of the first fitting portion F1B is larger than a width S2B of the second fitting portion F2B in the Y direction perpendicular to the Z direction.

When the first circuit board 41 and the second circuit board 51 are connected using the connector 11, the guide pin 24B of the first connector portion 21 is inserted into the first opening portion G1B of the first circuit board 41 and the second opening portion G2B of the second circuit board 51, and at this time, the first fitting portion F1B of the guide pin 24B is fitted in the first opening portion G1B of the first circuit board 41, while the second fitting portion F2B of the guide pin 24B is fitted in the second opening portion G2B of the second circuit board 51.

The width S2B, in the Y direction, of the second fitting portion F2B of the guide pin 24B formed at the −X directional end of the fitting plate 22 is larger then the width S1A, in the Y direction, of the first fitting portion F1A of the guide pin 24A formed at the +X directional end of the fitting plate 22. The widths S1A, S1B, S2A and S2B satisfy Inequality (1) below.

$$S2A<S1A<S2B<S1B \tag{1}$$

As shown in FIG. 6, the guide pins 24A and 24B have the same thickness SX in the X direction.

As shown in FIGS. 8 and 9, a width T1A, in the Y direction, of the first opening portion G1A formed at the +X directional end of the first circuit board 41 is larger than a width T2A, in the Y direction, of the second opening portion G2A formed at the +X directional end of the second circuit board 51, and a width T1B, in the Y direction, of the first opening portion G1B formed at the −X directional end of the first circuit board 41 is larger than a width T2B, in the Y direction, of the second opening portion G2B formed at the −X directional end of the second circuit board 51.

In addition, the width T1A, in the Y direction, of the first opening portion G1A formed at the +X directional end of the first circuit board 41 is smaller than the width T2B, in the Y direction, of the second opening portion G2B formed at the −X directional end of the second circuit board 51. The widths T1A, T1B, T2A and T2B satisfy Inequality (2) below.

$$T2A<T1A<T2B<T1B \tag{2}$$

The width T2A, in the Y direction, of the second opening portion G2A formed at the +X directional end of the second circuit board 51 is equal to or larger than the width S2A, in the Y direction, of the second fitting portion F2A of the guide pin 24A disposed at the +X directional end of the fitting plate 22 and smaller than the width S1A, in the Y direction, of the first fitting portion F1A of the guide pin 24A disposed at the +X directional end of the fitting plate 22.

The width T1A, in the Y direction, of the first opening portion G1A formed at the +X directional end of the first circuit board 41 is equal to or larger than the width S1A, in the Y direction, of the first fitting portion F1A of the guide pin 24A disposed at the +X directional end of the fitting plate 22 and smaller than the width S2B, in the Y direction, of the second fitting portion F2B of the guide pin 24B disposed at the −X directional end of the fitting plate 22.

The width T2B, in the Y direction, of the second opening portion G2B formed at the −X directional end of the second circuit board 51 is equal to or larger than the width S2B, in the Y direction, of the second fitting portion F2B of the guide pin 24B disposed at the −X directional end of the fitting plate 22 and smaller than the width S1B, in the Y direction, of the first fitting portion F1B of the guide pin 24B disposed at the −X directional end of the fitting plate 22.

The width T1B, in the Y direction, of the first opening portion G1B formed at the −X directional end of the first circuit board 41 is equal to or larger than the width S1B, in the Y direction, of the first fitting portion F1B of the guide pin 24B disposed at the −X directional end of the fitting plate 22.

In other words, the width S1A of the first fitting portion F1A and the width S2A of the second fitting portion F2A of the guide pin 24A, the width S1B of the first fitting portion F1B and the width S2B of the second fitting portion F2B of the guide pin 24B, the width T1A of the first opening portion G1A and the width T1B of the first opening portion G1B of the first circuit board 41, and the width T2A of the second opening portion G2A and the width T2B of the second opening portion G2B of the second circuit board 51 satisfy Inequality (3) below.

$$S2A\leq T2A<S1A\leq T1A<S2B\leq T2B<S1B\leq T1B \tag{3}$$

As shown in FIGS. 8 and 9, the first opening portion G1B of the first circuit board 41 and the second opening portion G2B of the second circuit board 51 each have a width TX1 in the X direction that is slightly larger than the thickness SX, in the X direction, of each of the guide pins 24A and 24B. On the other hand, the first opening portion G1A of the first circuit board 41 and the second opening portion G2A of the second circuit board 51 each have a width TX2 in the X direction that is larger than the width TX1, in the X direction, of each of the first opening portion G1B of the first circuit board 41 and the second opening portion G2B of the second circuit board 51.

Next, the method of connecting the first circuit board 41 and the second circuit board 51 using the connector 11 according to Embodiment 1 is described.

First, as shown in FIG. 10, the first circuit board 41 is placed on the +Z direction side of the first connector portion 21, and the first connector portion 21 and the first circuit board 41 are positioned with respect to each other. At this time, the first connector portion 21 and the first circuit board 41 are arranged such that the surface 41A of the first circuit board 41 on which the first contact portions 47A and 47B are formed faces in the +Z direction and that the first opening portions G1A and G1B of the first circuit board 41 are respectively positioned right above the guide pins 24A and 24B of the first connector portion 21.

Note that, in FIG. 10, the −X directional end of the first circuit board 41 is cut along a YZ plane in order to clearly show the relationship between the first fitting portion F1B of the guide pin 24B of the first connector portion 21 and the first opening portion G1B of the first circuit board 41.

In this state, the first circuit board 41 is relatively translated in the −Z direction toward the first connector portion

21, and as shown in FIG. 11, the first fitting portions F1A and F1B formed on the root side of the guide pins 24A and 24B of the first connector portion 21 are fitted into the first opening portions G1A and G1B of the first circuit board 41, respectively. Since, as represented by Inequality (3) above, the widths T1A and T1B, in the Y direction, of the first opening portions G1A and G1B of the first circuit board 41 are respectively equal to or larger than the widths S1A and S1B, in the Y direction, of the first fitting portions F1A and F1B of the guide pins 24A and 24B, the first fitting portions F1A and F1B can smoothly be fitted into the first opening portions G1A and G1B.

Note that, in FIG. 11, the −X directional ends of the first circuit board 41 and the second circuit board 51 are cut along a YZ plane in order to clearly show the relationship between the first fitting portion F1B and the second fitting portion F2B of the guide pin 24B of the first connector portion 21, the first opening portion G1B of the first circuit board 41, and the second opening portion G2B of the second circuit board 51.

In the above, if the order of the first circuit board 41 and the second circuit board 51 is incorrect, that is, if the second circuit board 51 is translated from the +Z direction side toward the first connector portion 21 so as to insert the guide pins 24A and 24B of the first connector portion 21 into the second opening portions G2A and G2B of the second circuit board 51, since, as represented by Inequality (3) above, the widths T2A and T2B, in the Y direction, of the second opening portions G2A and G2B are respectively smaller than the widths S1A and S1B, in the Y direction, of the first fitting portions F1A and F1B formed on the root side of the guide pins 24A and 24B, the first fitting portions F1A and F1B cannot be fitted in the second opening portions G2A and G2B of the second circuit board 51.

Alternatively, if the orientation of the first circuit board 41 in an XY plane is incorrect, that is, if the first circuit board 41 is translated toward the first connector portion 21 so as to insert the guide pins 24B and 24A of the first connector portion 21 into the first opening portions G1A and G1B of the first circuit board 41 with the first opening portion G1A being positioned on the −X directional end side and the first opening portion G1B being positioned on the +X directional end side, since, as represented by Inequality (3) above, the width T1A, in the Y direction, of the first opening portion G1A of the first circuit board 41 is smaller than the width S1B, in the Y direction, of the first fitting portion F1B formed on the root side of the guide pin 24B, the first fitting portion F1B of the guide pin 24B cannot be fitted in the first opening portion G1A of the first circuit board 41.

Thus, it is possible to prevent the first circuit board 41 and the second circuit board 51 from being disposed on the first connector portion 21 in a wrong order and prevent the first circuit board 41 from being arranged on the first connector portion 21 in a wrong orientation.

By fitting the first fitting portions F1A and F1B of the guide pins 24A and 24B into the first opening portions G1A and G1B of the first circuit board 41, the fitting plate 22 of the first connector portion 21 is inserted into the opening 44 formed in the first reinforcement plate 43 of the first circuit board 41.

At this time, the first fitting portions F1A and F1B of the guide pins 24A and 24B are accommodated in the first opening portions G1A and G1B of the first circuit board 41 and do not protrude in the +Z direction from the surface 41A of the first circuit board 41, while the second fitting portions F2A and F2B formed on the tip side of the guide pins 24A and 24B pass through the first opening portions G1A and G1B of the first circuit board 41 and protrude in the +Z direction from the surface 41A of the first circuit board 41.

Now, as shown in FIG. 11, the second circuit board 51 is placed on the +Z direction side of the first circuit board 41, and the first connector portion 21 and the second circuit board 51 are positioned with respect to each other. At this time, the second circuit board 51 is positioned with respect to the first connector portion 21 such that the surface 51A of the second circuit board 51 on which the second contact portions 57A and 57B are formed faces in the −Z direction and that the second opening portions G2A and G2B of the second circuit board 51 are respectively positioned right above the guide pins 24A and 24B of the first connector portion 21.

In this state, the second circuit board 51 is relatively translated in the −Z direction toward the first connector portion 21 and the first circuit board 41, and as shown in FIG. 12, the second fitting portions F2A and F2B formed on the tip side of the guide pins 24A and 24B of the first connector portion 21 are fitted into the second opening portions G2A and G2B of the second circuit board 51, respectively. Since, as represented by Inequality (3) above, the widths T2A and T2B, in the Y direction, of the second opening portions G2A and G2B of the second circuit board 51 are respectively equal to or larger than the widths S2A and S2B, in the Y direction, of the second fitting portions F2A and F2B of the guide pins 24A and 24B, the second fitting portions F2A and F2B can smoothly be fitted into the second opening portions G2A and G2B.

Note that, in FIG. 12, the −X directional ends of the first circuit board 41 and the second circuit board 51 are cut along a YZ plane in order to clearly show the relationship between the second fitting portion F2B of the guide pin 24B of the first connector portion 21 and the second opening portion G2B of the second circuit board 51.

In the above, if the orientation of the second circuit board 51 in an XY plane is incorrect, that is, if the second circuit board 51 is translated toward the first connector portion 21 so as to insert the guide pins 24B and 24A of the first connector portion 21 into the second opening portions G2A and G2B of the second circuit board 51 with the second opening portion G2A being positioned on the −X directional end side and the second opening portion G2B being positioned on the +X directional end side, since, as represented by Inequality (3) above, the width T2A, in the Y direction, of the second opening portion G2A of the second circuit board 51 is smaller than the width S2B, in the Y direction, of the second fitting portion F2B formed on the tip side of the guide pin 24B, the second fitting portion F2B of the guide pin 24B cannot be fitted in the second opening portion G2A of the second circuit board 51.

Thus, it is possible to prevent the second circuit board 51 from being disposed on the first connector portion 21 in a wrong orientation.

By fitting the second fitting portions F2A and F2B of the guide pins 24A and 24B into the second opening portions G2A and G2B of the second circuit board 51, the second circuit board 51 is overlapped on the first circuit board 41 such that the surface 51A of the second circuit board 51 faces the surface 41A of the first circuit board 41.

The connector 11 is configured such that, at this time, the tips of the guide pins 24A and 24B are disposed within the thickness range of the second circuit board 51 and the second fitting portions F2A and F2B of the guide pins 24A and 24B do not protrude in the +Z direction from the second circuit board 51. With this configuration, the connector 11 can be reduced in thickness.

After the first circuit board **41** and the second circuit board **51** are overlapped on each other on the first connector portion **21** as shown in FIG. **12**, the second connector portion **31** shown in FIGS. **1** and **2** is relatively moved in the −Z direction toward the first connector portion **21** so as to allow the projections **33** of the second connector portion **31** to sequentially pass through the second through holes **55** of the second circuit board **51** and the first through holes **45** of the first circuit board **41** and then fit into the fitting holes **23** of the first connector portion **21**. Thus, the first connector portion **21** and the second connector portion **31** are fitted with each other.

When the projections **33** of the second connector portion **31** are fitted into the fitting holes **23** of the first connector portion **21** through the first through holes **45** of the first circuit board **41** and the second through holes **55** of the second circuit board **51**, the pairs of first protruding pieces **46** protruding in the first through holes **45** of the first circuit board **41** and the pairs of second protruding pieces **56** protruding in the second through holes **55** of the second circuit board **51** are pushed in the −Z direction by the projections **33** and bent in the −Z direction in the fitting holes **23** of the first connector portion **21**. Then, the pair of first contact portions **47**A formed at each pair of first protruding pieces **46** of the first circuit board **41** and the pair of second contact portions **57**A formed at the corresponding pair of second protruding pieces **56** of the second circuit board **51** are opposed to and overlapped on each other, elastically pressed against each other to establish their contact between the lateral surface of the projection **33** and the inner surface of the fitting hole **23** by the aid of the elastic projection **33**, and reliably electrically connected to each other.

Likewise, the pair of first contact portions **47**B formed at each pair of first protruding pieces **46** of the first circuit board **41** and the pair of second contact portions **57**B formed at the corresponding pair of second protruding pieces **56** of the second circuit board **51** are opposed to and overlapped on each other, elastically pressed against each other to establish their contact between the lateral surface of the projection **33** and the inner surface of the fitting hole **23** by the aid of the elastic projection **33**, and electrically connected to each other.

Thus, the connected state between the first circuit board **41** and the second circuit board **51** is established.

As described above, the use of the connector **11** enables the first circuit board **41** and the second circuit board **51** to be reliably overlapped in a proper order and electrically connected to each other.

As described above, the first opening portion G**1**B of the first circuit board **41** and the second opening portion G**2**B of the second circuit board **51** each have the width TX**1** in the X direction that is slightly larger than the thickness SX, in the X direction, of each of the guide pins **24**A and **24**B; therefore, by fitting the guide pin **24**B in the first opening portion G**1**B of the first circuit board **41** and the second opening portion G**2**B of the second circuit board **51**, the first circuit board **41** and the second circuit board **51** can be positioned with respect to the first connector portion **21** in the X direction.

The first opening portion G**1**A of the first circuit board **41** and the second opening portion G**2**A of the second circuit board **51** each have the width TX**2** in the X direction that is larger than the width TX**1**, in the X direction, of each of the first opening portion G**1**B of the first circuit board **41** and the second opening portion G**2**B of the second circuit board **51**. Accordingly, even when the first connector portion **21**, the first circuit board **41** and the second circuit board **51** vary in size within predetermined production tolerances, the guide pin **24**A can be fitted in the first opening portion G**1**A of the first circuit board **41** and the second opening portion G**2**A of the second circuit board **51**.

While, in Embodiment 1 above, the first connector portion **21** has the two guide pins **24**A and **24**B, the first circuit board **41** and the second circuit board **51** can be prevented from being overlapped on the first connector portion **21** in a wrong order even with only one guide pin.

More specifically, it is assumed that, for instance, the first connector portion **21** has only one guide pin, the first circuit board **41** has one first opening portion, the second circuit board **51** has one second opening portion, and as with Inequality (3) above, widths S**1** and S**2**, in the Y direction, of a first fitting portion on the root side of the guide pin and a second fitting portion on the tip side thereof, a width T**1**, in the Y direction, of the first opening portion of the first circuit board **41**, and a width T**2**, in the Y direction, of the second opening portion of the second circuit board **51** satisfy the relationship:

$$S2 \leq T2 < S1 \leq T1 \tag{4}$$

In this case, if the order of the first circuit board **41** and the second circuit board **51** is incorrect, that is, if the guide pin of the first connector portion **21** is attempted to be inserted into the second opening portion of the second circuit board **51**, since the width T**2**, in the Y direction, of the second opening portion is smaller than the width S**1**, in the Y direction, of the first fitting portion formed on the root side of the guide pin, the first fitting portion cannot be fitted in the second opening portion of the second circuit board **51**.

Thus, it is possible to prevent the first circuit board **41** and the second circuit board **51** from being overlapped on the first connector portion **21** in a wrong order.

A lock mechanism for locking the second connector portion **31** may be provided at the +Z directional ends of the guide pins **24**A and **24**B of the first connector portion **21**. Provision of such a lock mechanism enables to lock the fitted state between the first connector portion **21** and the second connector portion **31** and maintain the connected state between the first circuit board **41** and the second circuit board **51**.

While, in Embodiment 1, the guide pins **24**A and **24**B are formed in the first connector portion **21**, the invention is not limited thereto; even when the guide pins **24**A and **24**B are formed in the second connector portion **31**, the first circuit board **41** and the second circuit board **51** can be reliably overlapped in a proper order and electrically connected to each other in the same manner.

While, in Embodiment 1, the projections **33** of the second connector portion **31** have elasticity, the invention is not limited thereto; even when the fitting holes **23** of the first connector portion **21** have elasticity and the projections **33** of the second connector portion **31** have excellent rigidity, the first connector portion **21** and the second connector portion **31** can be fitted with each other to establish the connected state between the first circuit board **41** and the second circuit board **51** by fitting the projections **33** of the second connector portion **31** in the fitting holes **23** of the first connector portion **21** through the first through holes **45** of the first circuit board **41** and the second through holes **55** of the second circuit board **51**.

Embodiment 2

FIG. **13** shows a connector **61** according to Embodiment 2 and a first circuit board **71** and a second circuit board **81** that are to be connected to each other by means of the connector **61**.

The connector **61** includes a base plate (flat plate portion) **62** having insulation properties and a plurality of projections **63** protrudingly formed on the surface of the base plate **62** facing in the +Z direction. The projections **63** are made of an insulating material such as insulating rubber for example and have elasticity at least in the Y direction.

The connector **61** has a guide pin **64** protrudingly formed in the +Z direction from an end of the base plate **62**.

The guide pin **64** includes a first fitting portion F**1** disposed on the root side, i.e., the −Z direction side of the guide pin **64** and a second fitting portion F**2** disposed on the tip side, i.e., the +Z direction side thereof. A width of the first fitting portion F**1** is larger than a width of the second fitting portion F**2** in the Y direction perpendicular to the Z direction.

The first circuit board **71** has the same structure as that of the first circuit board **41** used in Embodiment 1. Specifically, the first circuit board **71** includes a flexible first substrate **72** having insulation properties and a first reinforcement plate **73** joined to the −Z direction-side surface of the first substrate **72**. The first substrate **72** has a plurality of first through holes **75** of H shape. A pair of first protruding pieces **76** constituted of part of the flexible first substrate **72** are formed in each first through hole **75**, and a pair of first contact portions **77**A and a pair of first contact portions **77**B are formed on the pair of first protruding pieces **76** on a surface **71**A of the first circuit board **71** that faces in the +Z direction.

Further, the first circuit board **71** has a first opening portion G**1** formed at its one end that is formed of a hole penetrating both the first substrate **72** and the first reinforcement plate **73**.

The second circuit board **81** includes a second substrate **82** having insulation properties and rigidity and a plurality of circular through holes **85** penetrating the second substrate **82** in the Z direction. The through holes **85** have a substantially rectangular planar shape, and a pair of second contact portions **87**A and **87**B that are electrically insulated from each other are formed on the inner surface of each through hole **85**.

Further, the second circuit board **81** has a second opening portion G**2** formed at its one end that is formed of a hole penetrating the second substrate **82**.

The first opening portion G**1** of the first circuit board **71** has a width in the Y direction that is equal to or larger than the width, in the Y direction, of the first fitting portion F**1** of the guide pin **64**, and the second opening portion G**2** of the second circuit board **81** has a width in the Y direction that is equal to or larger than the width, in the Y direction, of the second fitting portion F**2** of the guide pin **64** and smaller than the width, in the Y direction, of the first fitting portion F**1**.

When the first circuit board **71** and the second circuit board **81** are connected using the connector **61**, first, as shown in FIG. **13**, the first circuit board **71** is placed on the +Z direction side of the connector **61**, while the second circuit board **81** is placed on the +Z direction side of the first circuit board **71**. At this time, the first circuit board **71** is positioned such that the surface **71**A on which the first contact portions **77**A and **77**B are formed faces in the +Z direction.

In this state, the first circuit board **71** and the second circuit board **81** are relatively translated in the −Z direction toward the connector **61** to fit the first fitting portion F**1** formed on the root side of the guide pin **64** of the connector **61** into the first opening portion G**1** of the first circuit board **71** and fit the second fitting portion F**2** formed on the tip side of the guide pin **64** into the second opening portion G**2** of the second circuit board **81**. At this time, since the first opening portion G**1** of the first circuit board **71** has the width in the Y direction that is equal to or larger than the width, in the Y direction, of the first fitting portion F**1** of the guide pin **64** and the second opening portion G**2** of the second circuit board **81** has the width in the Y direction that is equal to or larger than the width, in the Y direction, of the second fitting portion F**2** of the guide pin **64**, the first fitting portion F**1** and the second fitting portion F**2** of the guide pin **64** can smoothly be fitted into the first opening portion G**1** of the first circuit board **71** and the second opening portion G**2** of the second circuit board **81**, respectively.

Along with fitting the first fitting portion F**1** and the second fitting portion F**2** of the guide pin **64** into the first opening portion G**1** of the first circuit board **71** and the second opening portion G**2** of the second circuit board **81**, the projections **63** of the connector **61** pass through the first through holes **75** of the first circuit board **71** in the +Z direction and then are fitted into the through holes **85** of the second circuit board **81**.

When the projection **63** of the connector **61** passes through the first through hole **75** of the first circuit board **71** in the +Z direction, the pair of first protruding pieces **76** protruding in the first through hole **75** are bent in the +Z direction and each sandwiched between the lateral surface of the projection **63** of the connector **61** and the inner surface of the through hole **85** of the second circuit board **81**. Accordingly, the first contact portions **77**A and **77**B formed on the surfaces of the first protruding pieces **76** are elastically pressed against and come into contact with the second contact portions **87**A and **87**B formed on the inner surface of the through hole **85** of the second circuit board **81**, and are thereby electrically connected with the second contact portions **87**A and **87**B, respectively.

In the above, if the order of the first circuit board **71** and the second circuit board **81** is incorrect, that is, if the second circuit board **81** is translated from the +Z direction side toward the connector **61** to insert the guide pin **64** of the connector **61** into the second opening portion G**2** of the second circuit board **81**, since the width, in the Y direction, of the second opening portion G**2** is smaller than the width, in the Y direction, of the first fitting portion F**1** formed on the root side of the guide pin **64**, the first fitting portion F**1** cannot be fitted in the second opening portion G**2** of the second circuit board **81**.

Therefore, the use of the connector **61** according to Embodiment 2 also enables to prevent the first circuit board **71** and the second circuit board **81** from being disposed on the connector **61** in a wrong order and establish the connected state between the first circuit board **71** and the second circuit board **81**.

Also in Embodiment 2, as with Embodiment 1, the connector **61** may be configured such that the connector **61** includes two guide pins **64** protrudingly formed at the opposite ends, in the X direction, of the base plate **62**, the first circuit board **71** has two first opening portions G**1** formed at its opposite ends in the X direction, and the second circuit board **81** has two second opening portions G**2** formed at its opposite ends in the X direction. When the first fitting portions F**1** and the second fitting portions F**2** of the two guide pins **64**, the two first opening portions G**1** and the two second opening portions G**2** have Y directional widths satisfying the size relationship represented by Inequality (3) above, it is possible to prevent the first circuit board **71** and

the second circuit board **81** from being arranged not only in a wrong order but also in wrong orientations.

Embodiment 3

In Embodiment 1 above, as shown in FIG. **5**, the two guide pins **24**A and **24**B of the first connector portion **21** are disposed on the center line of the fitting plate **22** extending in the X direction, that is, the center of the guide pin **24**A and the center of the guide pin **24**B are in the same position in the Y direction; however, the invention is not limited thereto.

FIG. **14** is a plan view of a first connector portion **91** used in Embodiment 3, as viewed in the Z direction. The first connector portion **91** includes a fitting plate **92** having fitting holes **93** that are arranged in two rows each having eight fitting holes **93** arranged in the X direction, the two rows being arranged in the Y direction. Guide pins **94**A and **94**B are formed in the fitting plate **92** separately at its opposite ends in the X direction.

The two guide pins **94**A and **94**B are in different positions in the Y direction perpendicular to the direction in which each eight fitting holes **93** are arranged, hole the guide pin **94**A disposed at the +X directional end of the fitting plate **92** is disposed on a relatively −Y directional side of the fitting plate **92**, while the guide pin **94**B disposed at the −X directional end of the fitting plate **92** is disposed on a relatively +Y directional side of the fitting plate **92**.

Although not illustrated, a first circuit board and a second circuit board to be connected by the connector according to Embodiment 3 have first opening portions and second opening portions, respectively, in positions corresponding to the guide pins **94**A and **94**B of the first connector portion **91**.

By thus using the two guide pins **94**A and **94**B disposed in different positions in the Y direction, when the first circuit board or the second circuit board is placed upside down, the two first opening portions of the first circuit board or the two second opening portions of the second circuit board are to be disposed in positions not corresponding to the positions of the two guide pins **94**A and **94**B, so that the two guide pins **94**A and **94**B cannot be fitted in the two first opening portions or the two second opening portions.

Thus, it is possible to, in addition to preventing the first circuit board and the second circuit board from being disposed in a wrong order and in wrong orientations, prevent the first circuit board and the second circuit board from being installed upside down and establish the connected state between the first circuit board and the second circuit board.

Also when the base plate **62** has the two guide pins **64** at its opposite ends in the X direction in Embodiment 2, the two guide pins **64** may be disposed in different positions in the Y direction.

While, in Embodiments 1 to 3 above, the first opening portions G**1**A and G**1**B of the first circuit board **41**, the second opening portions G**2**A and G**2**B of the second circuit board **51**, the first opening portion G**1** of the first circuit board **71**, and the second opening portion G**2** of the second circuit board **81** are each formed as a through hole, each may be formed as, for example, a cut-out similarly to the first opening portions **91**A and **91**B of the first circuit board **91** shown in FIG. **15**.

While the guide pins **24**A and **24**B of the first connector portion **21**, the guide pin **64** of the connector **61**, and the guide pins **94**A and **94**B of the first connector portion **91** are each a plate member extending in the Y direction, the invention is not limited thereto. Each of these guide pins may be a plate member extending in the X direction or a plate member extending obliquely to the X direction and the Y direction as long as it projects in the Z direction and has a first fitting portion disposed on the root side and a second fitting portion disposed on the tip side.

Another example of a guide pin that may be used is a cylindrical member having a central axis extending in the Z direction, the cylindrical member being provided on its root side with a first fitting portion with a relatively large diameter and on its tip side with a second fitting portion with a diameter smaller than the diameter of the first fitting portion. When such a cylindrical guide pin is used, circular through holes are preferably used as a first opening portion of a first circuit board and a second opening portion of a second circuit board.

In Embodiments 1 to 3 above, two electric path systems constituted of the first contact portions **47**A and **47**B and the second contact portions **57**A and **57**B are formed in a single fitting hole **23**, and two electric path systems constituted of the first contact portions **77**A and **77**B and the second contact portions **87**A and **87**B are formed in a single through hole **85**; however, one or three or more electric path systems may be formed in a single fitting hole **23** or a single through hole **85** in the same manner.

The number of the first fitting holes **23**, **93** of the first connector portion **21**, **91**, the number of the projections **33** of the second connector portion **31**, the number of the first through holes **45** of the first circuit board **41**, and the number of the second through holes **55** of the second circuit board **51** in Embodiments 1 and 3 are each not limited to "16" and may each be one or more.

In Embodiments 1 to 3, the first circuit board **41**, **71** is constituted of a circuit board including the flexible first substrate **42**, **72** having insulation properties, and the second circuit board **51** is constituted of a circuit board including the flexible second substrate **52** having insulation properties; however, the invention is not limited thereto. The present invention is widely applicable to a connector that enables a first circuit board having a first contact portion and a second circuit board having a second contact portion to be overlapped on each other to electrically connect the first contact portion and the second contact portion to each other, and one or both of the first circuit board and the second circuit board may each be constituted of a printed circuit board or a rigid board.

What is claimed is:

1. A connector for overlapping a first circuit board having a first contact portion and a second circuit board having a second contact portion in a connecting direction to electrically connect the first contact portion and the second contact portion to each other, the connector comprising:

a first connector portion having a fitting hole;

a second connector portion having a projection corresponding to the fitting hole;

one or more guide pins protrudingly formed at one of the first connector portion and the second connector portion,

wherein each of the one or more guide pins includes a first fitting portion disposed on a root side of the guide pin and fitted with the first circuit board and a second fitting portion disposed on a tip side of the guide pin and fitted with the second circuit board, and the first fitting portion has a width larger than that of the second fitting portion in a direction perpendicular to the connecting direction,

wherein the first circuit board has a first through hole in which the first contact portion is disposed,

wherein the second circuit board has a second through hole in which the second contact portion is disposed,

wherein the first contact portion and the second contact portion are bendable,

wherein at least one of the projection and the fitting hole has elasticity, and

wherein when the projection of the second connector portion inserted in the first through hole of the first circuit board and the second through hole of the second circuit board is fitted into the fitting hole of the first connector portion, the first contact portion of the first circuit board and the second contact portion of the second circuit board are elastically pressed against each other between a lateral surface of the projection and an inner surface of the fitting hole to be electrically connected to each other.

2. The connector according to claim **1**,

wherein each of the one or more guide pins is configured such that a tip of the guide pin is disposed within a thickness range of the second circuit board when the second fitting portion is fitted with the second circuit board.

3. The connector according to claim **1**,

wherein the first fitting portion is fitted in a first opening portion formed in the first circuit board,

wherein the second fitting portion is fitted in a second opening portion formed in the second circuit board, and

wherein the width of the first fitting portion is larger than that of the second opening portion in the direction perpendicular to the connecting direction.

4. The connector according to claim **3**,

wherein, in order to define an order of overlapping of the first circuit board and the second circuit board,

in the direction perpendicular to the connecting direction,

a width T**2** of the second opening portion is equal to or greater than a width S**2** of the second fitting portion,

a width S**1** of the first fitting portion is greater than the width T**2**,

a width T**1** of the first opening portion is equal to or greater than the width S**1**.

5. The connector according to claim **3**,

wherein each of the first opening portion and the second opening portion comprises a hole or a cut-out penetrating the first circuit board and the second circuit board, respectively.

6. The connector according to claim **1**,

wherein two guide pins are protrudingly formed at the one of the first connector portion and the second connector portion as the one or more guide pins, and

wherein the first fitting portions of the two guide pins have different widths in the direction perpendicular to the connecting direction from each other.

7. The connector according to claim **6**,

wherein the first fitting portions of the two guide pins are fitted in two first opening portions formed in the first circuit board, and

wherein the second fitting portions of the two guide pins are fitted in two second opening portions formed in the second circuit board.

8. The connector according to claim **7**,

wherein, in order to define an order of overlapping and orientations of the first circuit board and the second circuit board,

in the direction perpendicular to the connecting direction,

a width T**2**A of the second opening portion G**2**A corresponding to the second fitting portion F**2**A of one of the two guide pins is equal to or greater than a width S**2**A of the second fitting portion F**2**A,

a width S**1**A the first fitting portion F**1**A of the one of the two guide pins is greater than the width T**2**A,

a width T**1**A of the first opening portion G**1**A corresponding to the first fitting portion F**1**A is equal to or greater than the width S**1**A,

a width S**2**B of the second fitting portion F**2**B of the other of the two guide pins is greater than the width T**1**A,

a width T**2**B of the second opening portion G**2**B corresponding to the second fitting portion F**2**B is equal to or greater than the width S**2**B,

a width S**1**B of the first fitting portion F**1**B of the other of the two guide pins is greater than the width T**2**B,

a width T**1**B of the first opening portion G**1**B corresponding to the first fitting portion F**1**B is equal to or greater than the width S**1**B.

9. The connector according to claim **6**,

wherein the first circuit board has a plurality of the first contact portions arranged,

wherein the second circuit board has a plurality of the second contact portions arranged correspondingly to the plurality of the first contact portions, and

wherein the two guide pins are disposed separately at opposite ends of the one of the first connector portion and the second connector portion in an arrangement direction in which the plurality of the first contact portions and the plurality of the second contact portions connected to each other are arranged.

10. The connector according to claim **9**,

wherein the two guide pins are disposed in different positions in a direction perpendicular to the arrangement direction.

11. A connector for overlapping a first circuit board having a first contact portion and a second circuit board having a second contact portion in a connecting direction to electrically connect the first contact portion and the second contact portion to each other, the connector comprising:

a flat plate portion; and

one or more guide pins protrudingly formed on a surface of the flat plate portion,

wherein each of the one or more guide pins includes a first fitting portion disposed on a root side of the guide pin and fitted with the first circuit board and a second fitting portion disposed on a tip side of the guide pin and fitted with the second circuit board, and the first fitting portion has a width larger than that of the second fitting portion in a direction perpendicular to the connecting direction,

wherein the first circuit board has a first through hole in which the first contact portion is disposed,

wherein the second circuit board has a second through hole in which the second contact portion is disposed,

wherein the connector includes a projection that is inserted into the first through hole of the first circuit board and the second through hole of the second circuit board so that the first contact portion and the second contact portion are connected to each other,

wherein the projection is protrudingly formed on the surface of the flat plate portion and has elasticity,

wherein the first contact portion is bendable,

wherein the second through hole of the second circuit board is formed of a through hole in which the second contact portion is formed on an inner surface thereof, and

wherein when the projection is fitted into the through hole, the first contact portion of the first circuit board is

elastically pressed against the inner surface of the through hole to electrically connect the first contact portion and the second contact portion to each other.

12. The connector according to claim **11**,

wherein each of the one or more guide pins is configured such that a tip of the guide pin is disposed within a thickness range of the second circuit board when the second fitting portion is fitted with the second circuit board.

13. The connector according to claim **11**,

wherein the first fitting portion is fitted in a first opening portion formed in the first circuit board,

wherein the second fitting portion is fitted in a second opening portion formed in the second circuit board, and

wherein the width of the first fitting portion is larger than that of the second opening portion in the direction perpendicular to the connecting direction.

14. The connector according to claim **13**,

wherein, in order to define an order of overlapping of the first circuit board and the second circuit board,

in the direction perpendicular to the connecting direction,

a width T**2** of the second opening portion is equal to or greater than a width S**2** of the second fitting portion,

a width S**1** of the first fitting portion is greater than the width T**2**,

a width T**1** of the first opening portion is equal to or greater than the width S**1**.

15. The connector according to claim **13**,

wherein each of the first opening portion and the second opening portion comprises a hole or a cut-out penetrating the first circuit board and the second circuit board, respectively.

16. The connector according to claim **11**,

wherein two guide pins are protrudingly formed on the surface of the flat plate portion as the one or more guide pins, and

wherein the first fitting portions of the two guide pins have different widths in the direction perpendicular to the connecting direction from each other.

17. The connector according to claim **16**,

wherein the first fitting portions of the two guide pins are fitted in two first opening portions formed in the first circuit board, and

wherein the second fitting portions of the two guide pins are fitted in two second opening portions formed in the second circuit board.

18. The connector according to claim **17**,

wherein, in order to define an order of overlapping and orientations of the first circuit board and the second circuit board,

in the direction perpendicular to the connecting direction,

a width T**2**A of the second opening portion G**2**A corresponding to the second fitting portion F**2**A of one of the two guide pins is equal to or greater than a width S**2**A of the second fitting portion F**2**A,

a width S**1**A the first fitting portion F**1**A of the one of the two guide pins is greater than the width T**2**A,

a width T**1**A of the first opening portion G**1**A corresponding to the first fitting portion F**1**A is equal to or greater than the width S**1**A,

a width S**2**B of the second fitting portion F**2**B of the other of the two guide pins is greater than the width T**1**A,

a width T**2**B of the second opening portion G**2**B corresponding to the second fitting portion F**2**B is equal to or greater than the width S**2**B,

a width S**1**B of the first fitting portion F**1**B of the other of the two guide pins is greater than the width T**2**B,

a width T**1**B of the first opening portion G**1**B corresponding to the first fitting portion F**1**B is equal to or greater than the width S**1**B.

19. The connector according to claim **16**,

wherein the first circuit board has a plurality of the first contact portions arranged,

wherein the second circuit board has a plurality of the second contact portions arranged correspondingly to the plurality of the first contact portions, and

wherein the two guide pins are disposed separately at opposite ends of the flat plate portion in an arrangement direction in which the plurality of the first contact portions and the plurality of the second contact portions connected to each other are arranged.

20. The connector according to claim **19**,

wherein the two guide pins are disposed in different positions in a direction perpendicular to the arrangement direction.

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